



Cooperative Research and Development Agreement

AIGER PEMS Correlation Program Report

FCA, Ford, GM, ECCC & EPA

April 2019 – June 2019

PD/20-01

July 2020

NOTE: This report is published by the Automobile Industry/Government Emissions Research (AIGER) CRADA for research and development and educational purposes only and does not endorse or warrant any products or procedures cited in the report. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user. Opinions, findings, conclusions or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the U.S. Environmental Protection Agency or of the AIGER CRADA.

Comments on this report may be directed to the appropriate technical representative or to:

Daniel McBryde
U.S. Environmental Protection Agency
2565 Plymouth Road
Ann Arbor, MI 48105
Telephone: (734) 214-4328
Email: mcbryde.dan@epa.gov

AIGER PEMS Correlation Program
FCA, Ford, GM, ECCC & EPA

April 2019 – June 2019



2018 Chrysler Pacifica

Table of Contents

Program Overview	5
Test Schedule	5
Vehicle	5
Test Procedure.	6
Driver	6
Vehicle Preparation and Preconditioning.....	6
Vehicle Test Procedure	6
Data Requirements	6
Analysis of Data.....	7
Abbreviations	7
Discussion of Results	8
General	8
WLTP	8
Comments and Questions.....	9
WLTP Triangle Plots	9
Span Gas Concentrations	19
Dynamometer Load Curves	20
Fuel Properties Summary.....	21
WLTP Data	22
WLTP Phase 1 Data.....	23
WLTP Phase 2 Data.....	24
WLTP Phase 3 Data.....	25
WLTP Phase 4 Data.....	26
WLTP Modal Data – Total	27
WLTP Phase 1 Modal Data	28
WLTP Phase 2 Modal Data	29
WLTP Phase 3 Modal Data	30
WLTP Phase 4 Modal Data	31
WLTP PEMS Data.....	32
 Figure 1 – WLTP bag, modal and PEMS HC.....	10
Figure 2 – WLTP bag, modal and PEMS CO	11
Figure 3 – WLTP bag, modal and PEMS NOx.....	12
Figure 4 – WLTP bag, modal and PEMS CO2	13
Figure 5 – WLTP bag, modal and PEMS NMHC	14
Figure 6 – WLTP bag, modal and PEMS total CH4.....	15
Figure 7 – WLTP bag, modal and PEMS CBFE	16
Figure 8 –PEMS Exh Flow	17
Figure 9 – WLTP Distance	17
Figure 10 –WLTP IWR.....	18
Figure 11 – WLTP EER	18
Figure 12 – FTP ASCR.....	19
Figure 13 – Dynamometer Curve Comparison	20
 Table 1 – Span gas concentrations	19
Table 2 – PEMS make and model.....	19
Table 3 – Fuel Properties	21
Table 4 – WLTP Total Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC.....	22
Table 5 - WLTP Phase1 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	23
Table 6 - WLTP Phase2 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	24

Table 7 - WLTP Phase3 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	25
Table 8 - WLTP Phase4 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	26
Table 9 - WLTP Modal Total Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	27
Table 10 - WLTP Phase1Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	28
Table 11 - WLTP Phase2 Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	29
Table 12 - WLTP Phase3 Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	30
Table 13 - WLTP Phase4 Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	31
Table 14 - WLTP PEMS Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC	32

Program Overview

This program is designed to determine correlation on PEMS with test cell sampling systems among the certification emissions laboratories of FCA (CPG), EPA's National Vehicle and Fuel Emissions Laboratory (NVFEL), Ford Allen Park (APTL), Environment and Climate Change Canada (ECCC) and General Motors Proving Grounds (GM) using emissions and fuel economy data from an engineering test vehicle.

All testing is assessed using tabular and graphical presentations.

Test Schedule

Testing on one test cell is requested. Three valid test days per laboratory are required.

<u>Test Facility</u>	<u>Test Dates</u>
FCA_CPG	April 1 st – 5 th
Ford	April 8 th – 26 th
GM	April 29 th – May 10 th
EPA	May 13 th – 24 th
FCA_CPG_Conf	May 27 th – June 7 th
ECCC	Sep 1 st – Sep 30 th

Vehicle

Model	Chrysler Pacifica
Year	2018
Color	Blue
VIN	2C4RC1GG6JR338517
License Plate #	032M585
Engine	3.6L V6 24VVT wESS
Drive Axle	FWD
Transmission	9 - Spd 948TE Auto
Fuel Type	Gasoline, Tier III Federal Fuel
Tank Capacity	19 (gallons)
Tire Pressure	Front: 36 Rear: 36 (psi)
Tire Size and Type	235/60R18 Bridgestone All Season
ETW	4750 (lbs)
Target Coefficients	A = 38.24 (lbf), B = 0.2803 (lbf/mph), C = 0.02328 (lbf/(mph) ²)
Coast Down Time (55-45 mph)	19.96 (seconds)

Certification type fuel-tank drain and exhaust flange are installed on the vehicle. The traction control and ABS braking has been disabled. There will be warning lights on the instrument panel indicating faults. ESS on the vehicle is to be disabled before running any emission tests.

Test Procedure

Driver

Each laboratory shall provide one of their own certification drivers to conduct this testing. Same driver shall be used for all tests.

Vehicle Preparation and Preconditioning

- 1) Drain and fill the vehicle to 10 gallons with Tier III E10 Federal fuel.
- 2) Set rear tire pressure to 36 psig.
- 3) Make sure the vehicle is in “dyno testing” mode.
- 4) Conduct a standard SAE 2264 road-load derivation on the dynamometer. The derived coefficients will be used for all subsequent testing.
- 5) Conduct an WLTP with no emissions to precondition the vehicle.
- 6) Use 2.5” exhaust flow meter (2” to be used if 2.5” not available at lab).
- 7) Soak vehicle for 12-36 hours (around 24 hours is preferred).

Vehicle Test Procedure

- 1) Set rear tire pressure to 36 psig.
- 2) Have the PEMS unit warmed up per manufacturer recommendations before start of the test.
- 3) Use Nitrogen gas for PEMS pre-calibration (and not Ambient air).
- 4) Perform calibration of site analyzers (Bag & Raw) and PEMS equipment.
- 5) Perform audit bottle pre-test check, if available, for PEMS equipment.
- 6) If possible, route PEMS sample through unit then back to exhaust stream.
- 7) With the PEMS unit installed, operate the CVS at the test flow rate and re-zero the PEMS exhaust flow meter to account for any differential pressure when the CVS blower is operating.
- 8) Disable ESS by pressing button under the touch screen (photo attached later in document). Note that a key cycle will reset the button. Please make sure to switch it off after every key ON.
- 9) Make sure the vehicle is in “dyno testing” mode (see picture at the end of this document).
- 10) Conduct a cold start WLTP test with Test Cell Bag, Test Cell Raw & PEMS modal emissions. Use WLTP fan for vehicle cooling. Position fan 12” from the front of the vehicle and the height at 9” from floor to bottom of air flow vent.
- 11) Perform quick-check Coastdown (55 – 45mph).
- 12) Perform post-test span/zero check on site analyzers (Bag & Raw) and PEMS equipment.
- 13) Perform audit bottle post-test check, if available, on PEMS equipment.
- 14) Soak vehicle for 12-36 hours (around 24 hours is preferred).
- 15) Repeat steps 1 through 14 until three valid tests are completed.

Data Requirements

- Road load derivation results.
- WLTP emissions (NOx (NO + NO₂ for PEMS), CO, CO₂, THC & CH₄), exhaust flow and fuel consumption from the following sources:
 - Test Cell Bag
 - Bag measurements shall be corrected for the emissions mass removed by the Test Cell Raw measurement
 - Test Cell Raw
 - PEMS
 - PEMS Mass Emission Rates will be calculated using the dynamometer distance
- All emission results to be reported in SI units.
- Emission rates and fuel consumption shall be reported per phase and total.
- Span gas bottle concentrations used for PEMS calibration.

- Audit bottle concentrations if used for PEMS equipment.
- PEMS unit make and model.
- Drive metrics (i.e., ER, EER and ASCR ratings).
- “10 Hz” data with time, dynamometer speed, scheduled speed (only if drive metrics are not provided).
- Coast down time
- Fuel analysis data

Analysis of Data

Data is presented as tables and triangle plots in this report. Correlation between laboratories was assessed using a student t-test to mean of All labs’ bag data. Correlation between bag and PEMS data was assessed using a student t-test for each lab. Data from all tests was used unless otherwise noted. If a test was rejected an explanation is given.

The following acceptance limits will be used for graphical assessments:

<u>TRIANGLE PLOT</u>	<u>ACCEPTANCE LIMIT</u>
HC	+/- 2 standard deviations about All labs bag mean
NMHC	+/- 2 standard deviations about All labs bag mean
CH ₄	+/- 2 standard deviations about All labs bag mean
CO	+/- 2 standard deviations about All labs bag mean
NOx	+/- 2 standard deviations about All labs bag mean
CO ₂	+/- 2 % of All labs bag mean
Fuel Consumption	+/- 2 % of All labs bag mean
Distance	+/- 1 % of the CFR specified value
IWR	+/- 2 of the SAE J2951 specified rating of 0 (zero)
EER	+/- 2 of the SAE J2951 specified rating of 0 (zero)
ASCR	+/- 4 of the SAE J2951 specified rating of 0 (zero)

Abbreviations

ASCR	– Absolute Speed Change Rating (SAE J2951 Drive Quality Metrics)
CH ₄	– Methane
CO	– Carbon Monoxide
CO ₂	– Carbon Dioxide
CPG	– Chrysler Group - Chelsea Proving Grounds
ECCC	– Environment and Climate Change Canada
EER	– Energy Economy Rating (SAE J2951 Drive Quality Metrics)
EPA	– Environmental Protection Agency
ER	– Energy Rating (SAE J2951 Drive Quality Metrics)
GM	– General Motors Milford Proving Grounds
NMHC	– Non-Methane Hydrocarbon
NVFEL	– EPA National Vehicle and Fuel Emissions Laboratory
NOx	– Oxides of Nitrogen
PEMS	– Portable Emission Measurement System
THC	– Total Hydrocarbon

Discussion of Results

General

Laboratory mean results were used for lab to lab statistical differences in this report. ***For the remainder of this document, the stated statistical differences were determined using t-test results with a confidence level of 95%.***

WLTP

The following is a discussion of the WLTP results. Color legend: Bag, **Modal**, **PEMS**.

THC

- Mean bag results for all the labs were within the suggested limits of +/- 2 standard deviations about the overall bag mean.
- EPA data had high variability due to the vehicle THC emissions being higher on the first test compared to the other two tests. This was reflected in all instrumentation (Bag, PEMS and Modal) reporting higher THC emissions for the first test.
- There was no statistical difference among any of the labs.

CO

- Mean bag results for all the labs were within the suggested limits of +/- 2 standard deviations about the overall bag mean.
- EPA data had high variability due to the vehicle CO emissions being higher on the first test compared to the other two tests. This was reflected in all instrumentation (Bag, PEMS and Modal) reporting higher CO emissions for the first test.
- There was no statistical difference among any of the labs.

NOx

- Mean bag results for all the labs were within the suggested limits of +/- 2 standard deviations about the overall bag mean.
- EPA used a calculated exhaust flow for their modal data which had a negative offset. This resulted in lower net emissions for the modal data.
- FCA-CPG baseline and GM modal data were statistically different from all labs' bag means.
- GM and ECCC PEMS data were statistically different from all labs' bag means.

CO₂

- Mean bag results for all the labs were within the suggested limits of +/- 2 standard deviations about the overall bag mean.
- FCA-CPG baseline, GM and EPA modal data were statistically different than all labs' bag means.
- EPA modal data showed high variability. EPA used a calculated exhaust flow for their modal data which had a negative offset. This resulted in lower net emissions for the modal data and contributed to the higher variability.
- FCA-CPG, ECCC and Ford PEMS data were statistically different than all labs' bag means.
- FCA-CPG PEMS data had higher CO₂ numbers, most likely due to higher exhaust volume measured by PEMS.

NMHC

- Mean bag results for all the labs were within the suggested limits of +/- 2 standard deviations about the overall bag mean.

- FCA-CPG confirmatory test result was statistically different from all labs' bag means.

CH₄

- Mean bag results for all the labs were within the suggested limits of +/- 2 standard deviations about the overall bag mean.
- FCA-CPG confirmatory PEMS CH₄ numbers were high due to its non-methane cutter, which needs to be checked. Data was statistically different.

Fuel Consumption

- Mean bag results for all the labs were within the suggested limits of +/- 2 standard deviations about the overall bag mean.
- EPA modal data showed high variability. EPA used a calculated exhaust flow for their modal data which had a negative offset. This resulted in lower net emissions for the modal data and contributed to the higher variability.
- FCA-CPG data and ECCC PEMS data were both high and statistically different from all labs' bag means.
- NOTE: Ford PEMS equipment is not currently capable of collecting HC emissions. Fuel consumption values could not be confirmed for accuracy.

Distance

- Mean results for all labs were within the suggested limits of +/- 1% of the CFR specified value.
- EPA distance was higher and significantly different from all labs' means. IWR was also statistically different suggesting possible over-acceleration of the driving trace.

Drive IWR

- Mean results for all the labs except GM and EPA were within the suggested limits of +/- 2 of the SAE J2951 specified rating of zero.
- EPA IWR was also statistically different suggesting possible over-acceleration on some parts of the driving trace.

Drive EER

- Mean results for all the labs were within the suggested limits of +/- 2 of the SAE J2951 specified rating of zero.

Drive ASCR

- Mean results for all the labs were within the suggested limits of +/- 4 of the SAE J2951 specified rating of zero.

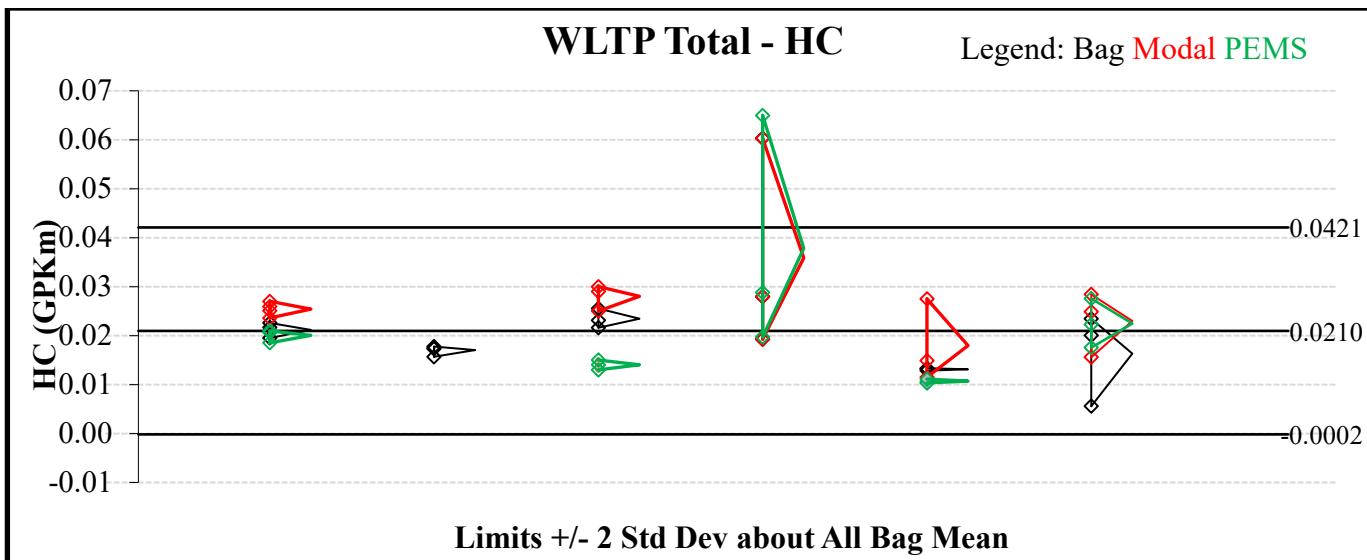
Comments and Questions:

FCA US LLC
 800 Chrysler Dr
 Auburn Hills, Michigan
 313-485-5176
amandeep.singh@fcagroup.com

FCA US LLC
 800 Chrysler Dr
 Auburn Hills, Michigan
 248-944-0876
mahmoud.yassine@fcagroup.com

US EPA NVFEL
 2565 Plymouth Rd
 Ann Arbor, Michigan
 734-214-4328
mcbryde.dan@epa.gov

WLTP Triangle Plots

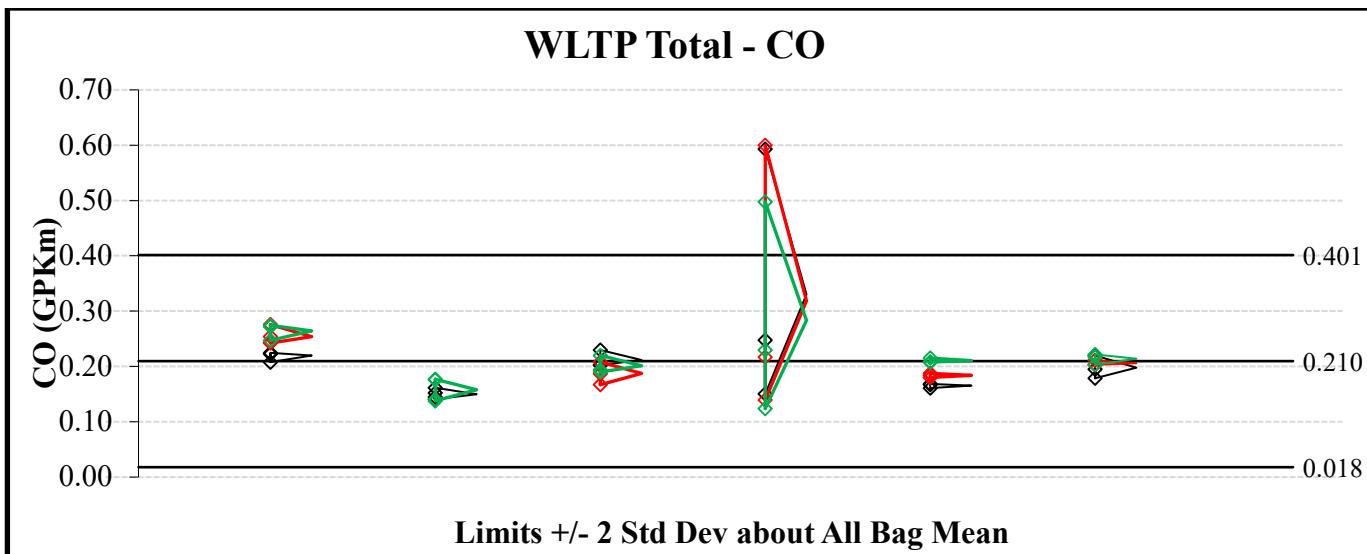


Total (Bag)	FCA_CPG	Ford	GM	EPA	FCA_CPG_conf	ECCC
Mean	0.0212	0.0171	0.0234	0.0358	0.0131	0.0163
Std Dev	0.0013	0.0009	0.0020	0.0216	0.0003	0.0095
CV	6.1680	5.5013	8.4542	60.30	1.9566	58.0427
%Diff to All Bag Mean	1.0413	-18.5990	11.7961	71.03	-37.4120	-22.0044
T-test - All Bag Mean	No Difference					

Total (Modal)	FCA_CPG	Ford	GM	EPA	FCA_CPG_conf	ECCC
Mean	0.0254	---	0.0280	0.0358	0.0180	0.0230
Std Dev	0.0014	---	0.0026	0.02	0.0084	0.0066
CV	5.6324	---	9.4491	60.30	46.9164	28.8713
%Diff to All Modal Mean	-2.2758	---	7.7274	37.87	-30.8749	-9.6297
%Diff to All Bag Mean	21.2304	---	33.6398	71.03	-14.2478	9.5563
T-test to All Bag Mean	No Difference	---	No Difference	No Difference	No Difference	No Difference

Total (PEMS)	FCA_CPG	Ford	GM	EPA	FCA_CPG_conf	ECCC
Mean	0.0200	---	0.0140	0.0378	0.0107	0.0225
Std Dev	0.0013	---	0.0010	0.02	0.0004	0.0050
CV	6.5828	---	7.1429	63.31	3.7118	22.3089
%Diff to All PEMS Mean	-4.6481	---	-33.3218	80.13	-49.1500	6.9896
%Diff to All Bag Mean	-4.4454	---	-33.1801	80.51	-49.0419	7.2170
T-test to All Bag Mean	No Difference	---	No Difference	No Difference	No Difference	No Difference

Figure 1 – WLTP Bag, Modal and PEMS HC

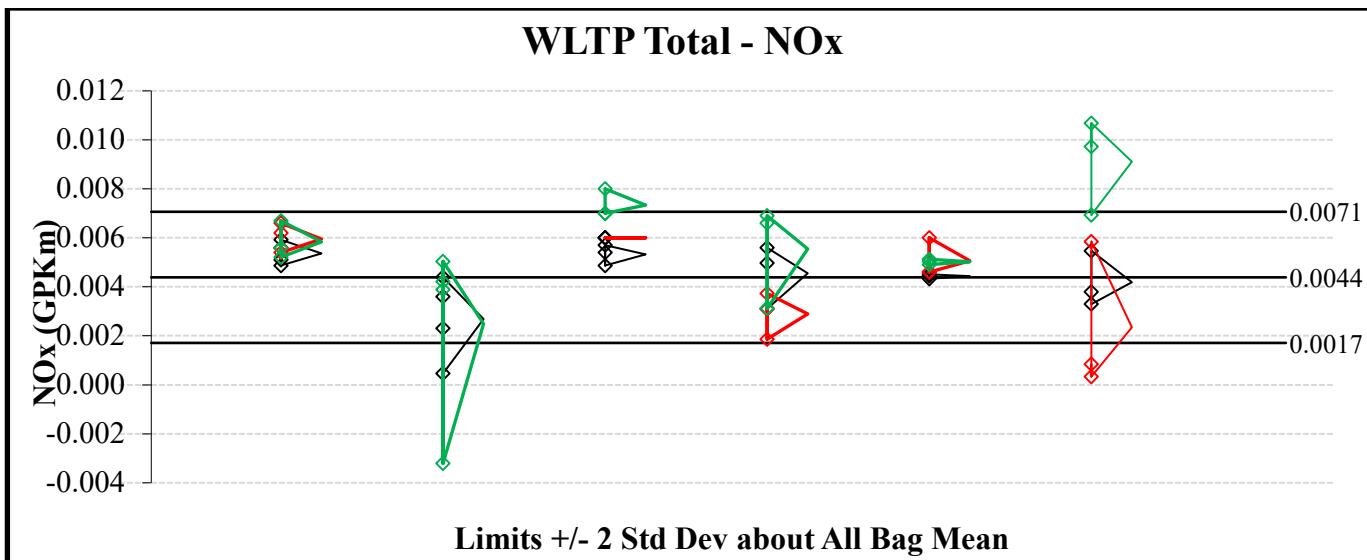


Total (Bag)	FCA_CPG	Ford	GM	EPA	FCA_CPG conf	ECCC
Mean	0.220	0.150	0.212	0.330	0.165	0.198
Std Dev	0.0079	0.0091	0.0156	0.23	0.0040	0.0208
CV	3.5838	6.0556	7.3875	70.44	2.4207	10.5008
%Diff to All Bag Mean	4.7397	-28.5488	0.9645	57.51	-21.0600	-5.6718
T-test to All Bag Mean	No Difference					

Total (Modal)	FCA_CPG	Ford	GM	EPA	FCA_CPG conf	ECCC
Mean	0.254	---	0.187	0.319	0.184	0.206
Std Dev	0.0152	---	0.0205	0.25	0.0038	0.0045
CV	5.9747	---	10.9441	77.38	2.0505	2.2058
%Diff to All Modal Mean	9.7859	---	-19.0771	37.61	-20.4738	-19.0342
%Diff to All Bag Mean	21.2461	---	-10.6298	51.98	-12.1723	-1.8322
T-test to All Bag Mean	No Difference	---	No Difference	No Difference	No Difference	No Difference

Total (PEMS)	FCA_CPG	Ford	GM	EPA	FCA_CPG conf	ECCC
Mean	0.264	0.158	0.201	0.284	0.210	0.214
Std Dev	0.0150	0.0215	0.0163	0.19	0.0041	0.0097
CV	5.6665	13.6202	8.0906	67.89	1.9616	4.5437
%Diff to All PEMS Mean	21.0350	-27.8297	-7.8465	29.79	-3.7408	-2.1330
%Diff to All Bag Mean	26.1516	-24.7788	-3.9509	35.28	0.3284	2.0042
T-test to All Bag Mean	No Difference					

Figure 2 – WLTP Bag, Modal and PEMS CO

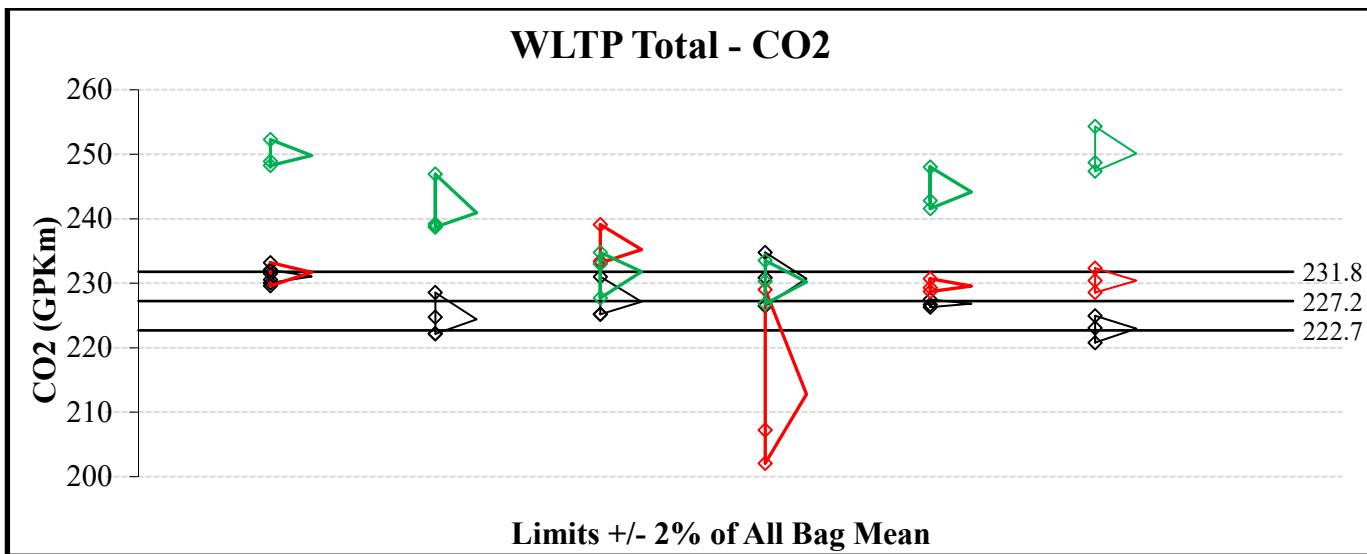


Total (Bag)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0054	0.0027	0.0053	0.0046	0.0044	0.0042
Std Dev	0.0005	0.0017	0.0004	0.00	0.0001	0.0011
CV	8.8011	63.7970	7.8950	28.39	2.0689	27.2731
%Diff to All Bag Mean	22.3743	-38.6704	21.3673	3.89	1.0001	-4.5334
T-test to All Bag Mean	No Difference					

Total (Modal)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0060	---	0.0060	0.0029	0.0051	0.0023
Std Dev	0.0006	---	0.0000	0.00	0.0008	0.0030
CV	9.2564	---	0.0000	32.73	15.9531	130.0887
%Diff to All Modal Mean	30.9015	---	32.0015	-36.20	11.4679	-60.6338
%Diff to All Bag Mean	35.6548	---	36.7947	-33.89	15.5156	-46.5979
T-test to All Bag Mean	Difference	---	Difference	No Difference	No Difference	No Difference

Total (PEMS)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0058	0.0025	0.0073	0.0055	0.0050	0.0091
Std Dev	0.0008	0.0038	0.0006	0.00	0.0001	0.0019
CV	13.2744	153.9111	7.8730	37.85	2.1689	21.3672
%Diff to All PEMS Mean	2.1484	-56.4647	28.4485	-2.93	-12.0254	59.6450
%Diff to All Bag Mean	32.9603	-43.3328	67.1936	26.35	14.5111	107.8001
T-test to All Bag Mean	No Difference	No Difference	Difference	No Difference	No Difference	Difference

Figure 3 – WLTP Bag, Modal and PEMS NOx

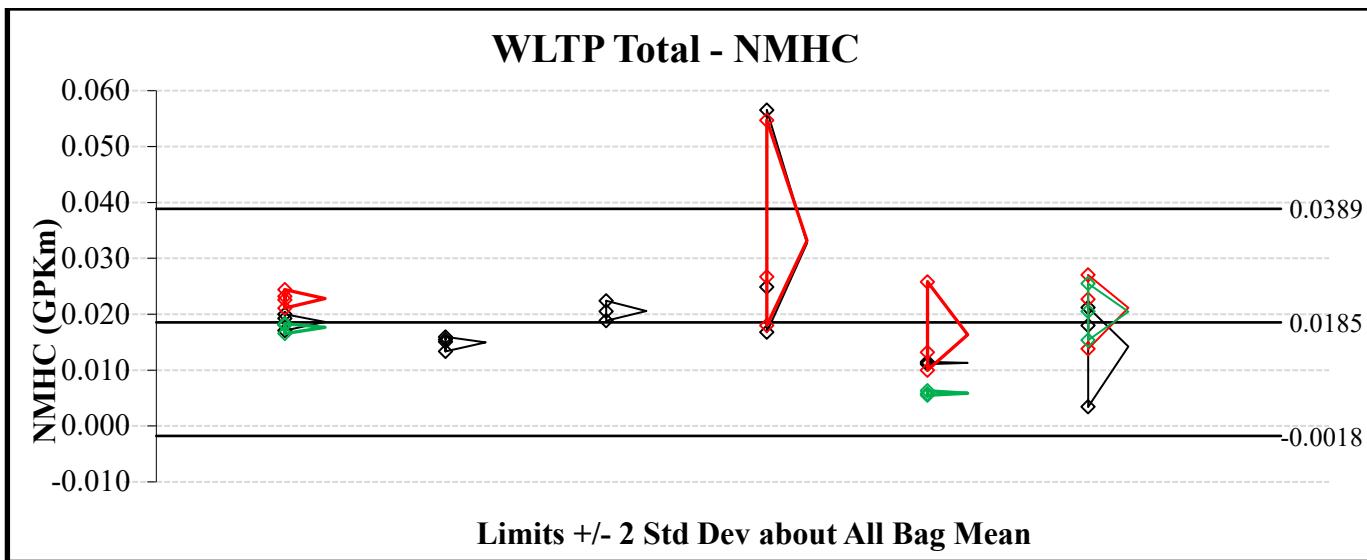


Total (Bag)	FCA_CPG	Ford	GM	EPA	FCA_CPG conf	ECCC
Mean	231.0	224.4	227.1	230.7	226.8	222.9
Std Dev	0.9091	3.0218	3.3599	4.13	0.6032	2.0830
CV	0.3935	1.3466	1.4793	1.79	0.2659	0.9343
%Diff to All Bag Mean	1.6799	-1.2441	-0.0412	1.53	-0.1829	-1.8876
T-test to All Bag Mean	No Difference					

Total (Modal)	FCA_CPG	Ford	GM	EPA	FCA_CPG conf	ECCC
Mean	231.7	---	235.2	212.8	229.6	230.4
Std Dev	1.5100	---	3.3557	14.28	1.0263	1.8985
CV	0.6517	---	1.4266	6.71	0.4471	0.8239
%Diff to All Modal Mean	1.5471	---	3.0897	-6.75	0.6122	-0.5528
%Diff to All Bag Mean	1.9685	---	3.5175	-6.36	1.0297	1.4049
T-test to All Bag Mean	Difference	---	Difference	Difference	No Difference	No Difference

Total (PEMS)	FCA_CPG	Ford	GM	EPA	FCA_CPG conf	ECCC
Mean	249.8	240.9	231.8	230.2	244.1	250.1
Std Dev	2.1527	3.9886	3.6726	3.36	3.4342	3.6863
CV	0.8617	1.6555	1.5843	1.46	1.4067	1.4738
%Diff to All PEMS Mean	3.5917	-0.0958	-3.8756	-4.54	1.2344	3.7152
%Diff to All Bag Mean	9.9420	6.0284	2.0170	1.31	7.4401	10.0730
T-test to All Bag Mean	Difference	Difference	No Difference	No Difference	Difference	Difference

Figure 4 – WLTP Bag, Modal and PEMS CO2

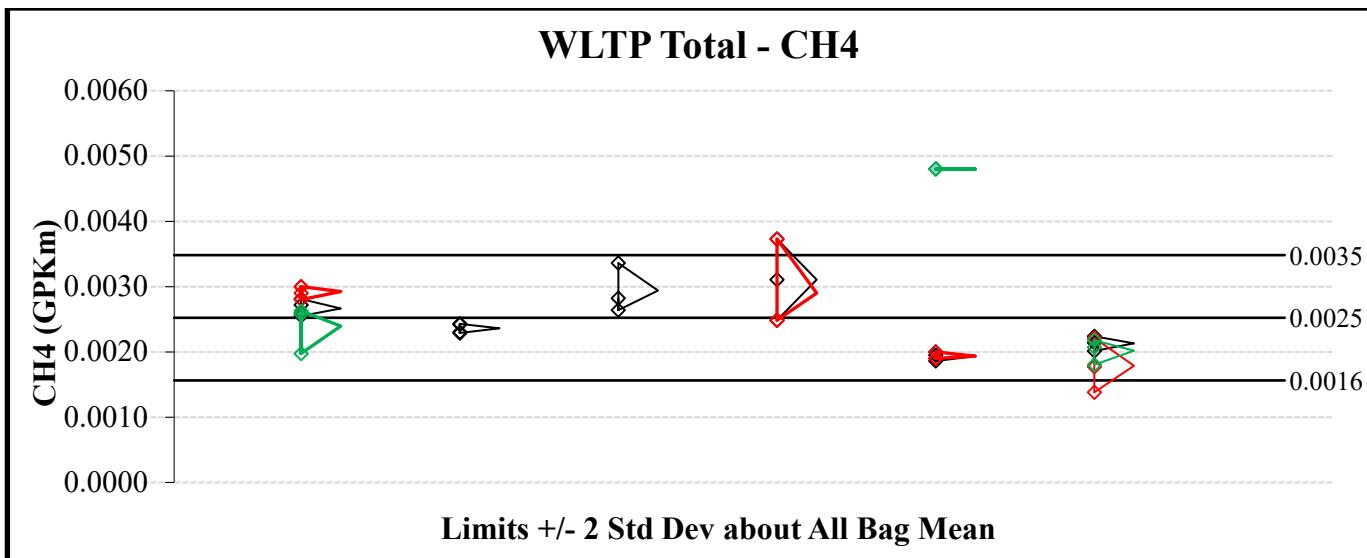


Total (Bag)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0186	0.0150	0.0206	0.0327	0.0113	0.0142
Std Dev	0.0013	0.0011	0.0018	0.02	0.0002	0.0095
CV	6.7883	7.5766	8.7043	64.23	1.8635	66.6587
%Diff to All Bag Mean	0.5467	-19.3037	11.0113	76.53	-39.1901	-23.3460
T-test to All Bag Mean	No Difference					

Total (Modal)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0228	---	---	0.0331	0.0163	0.0212
Std Dev	0.0014	---	---	0.02	0.0084	0.0067
CV	6.0111	---	---	57.80	51.1411	31.8269
%Diff to All Modal Mean	-2.1415	---	---	42.09	-29.9735	-7.2737
%Diff to All Bag Mean	23.1211	---	---	78.77	-11.8958	14.1657
T-test to All Bag Mean	No Difference	---	---	No Difference	No Difference	No Difference

Total (PEMS)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0176	---	---	---	0.0059	0.0204
Std Dev	0.0010	---	---	---	0.0004	0.0051
CV	5.4222	---	---	---	6.8888	24.7567
%Diff to All PEMS Mean	20.3601	---	---	---	-59.9415	39.5813
%Diff to All Bag Mean	-4.9175	---	---	---	-68.3544	10.2670
T-test to All Bag Mean	No Difference	---	---	---	Difference	No Difference

Figure 5 – WLTP Bag, Modal and PEMS NMHC



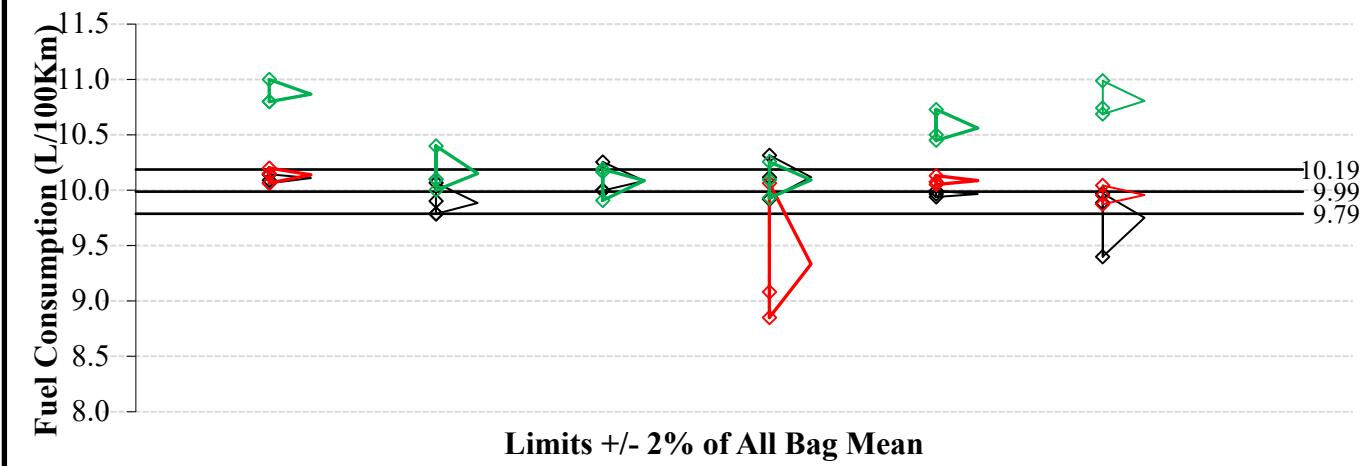
Total (Bag)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0027	0.0024	0.0029	0.0031	0.0019	0.0021
Std Dev	0.0001	0.0001	0.0004	0.00	0.0001	0.0001
CV	4.4816	3.1897	12.7449	20.00	3.6633	5.2790
%Diff to All Bag Mean	5.7406	-6.4488	16.5426	23.16	-23.2299	-15.5309
T-test to All Bag Mean	No Difference					

Total (Modal)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0029	---	---	0.0029	0.0019	0.0018
Std Dev	0.0001	---	---	0.00	0.0001	0.0004
CV	3.2733	---	---	24.74	2.9863	23.2773
%Diff to All Modal Mean	20.4565	---	---	19.42	-20.3820	-38.8283
%Diff to All Bag Mean	15.9480	---	---	14.95	-23.3620	-29.0727
T-test to All Bag Mean	No Difference	---	---	No Difference	No Difference	No Difference

Total (PEMS)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.0024	---	---	---	0.0048	0.0020
Std Dev	0.0004	---	---	---	0.0000	0.0002
CV	15.1576	---	---	---	0.0000	9.6135
%Diff to All PEMS Mean	-22.0585	---	---	---	56.3122	-34.2537
%Diff to All Bag Mean	-5.1244	---	---	---	90.2736	-19.9692
T-test to All Bag Mean	No Difference	---	---	---	Difference	No Difference

Figure 6 – WLTP Bag, Modal and PEMS total CH4

WLTP Total - Fuel Consumption

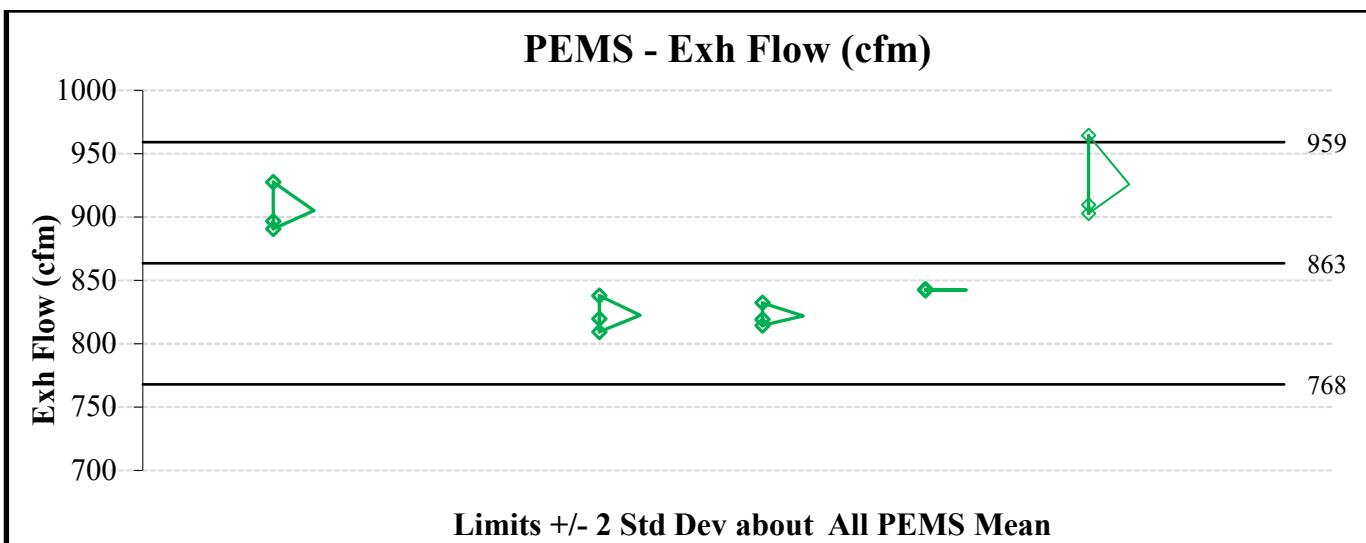


Total (Bag)	FCA_CPG	Ford	GM	EPA	FCA_CPG_conf	ECCC
Mean	10.11	9.89	10.08	10.12	9.97	9.75
Std Dev	0.0405	0.1326	0.1482	0.20	0.0275	0.3081
CV	0.4011	1.3413	1.4695	1.96	0.2759	3.1592
%Diff to All Bag Mean	1.2284	-1.0187	0.9695	1.30	-0.2093	-2.3440
T-test to All Bag Mean	No Difference					

Total (Modal)	FCA_CPG	Ford	GM	EPA	FCA_CPG_conf	ECCC
Mean	10.14	---	---	9.33	10.09	9.96
Std Dev	0.0560	---	---	0.64	0.0412	0.0848
CV	0.5522	---	---	6.90	0.4083	0.8517
%Diff to All Modal Mean	2.4360	---	---	-5.73	1.8953	-1.8083
%Diff to All Bag Mean	1.5295	---	---	-6.56	0.9936	-0.3065
T-test to All Bag Mean	No Difference	---	---	Difference	No Difference	No Difference

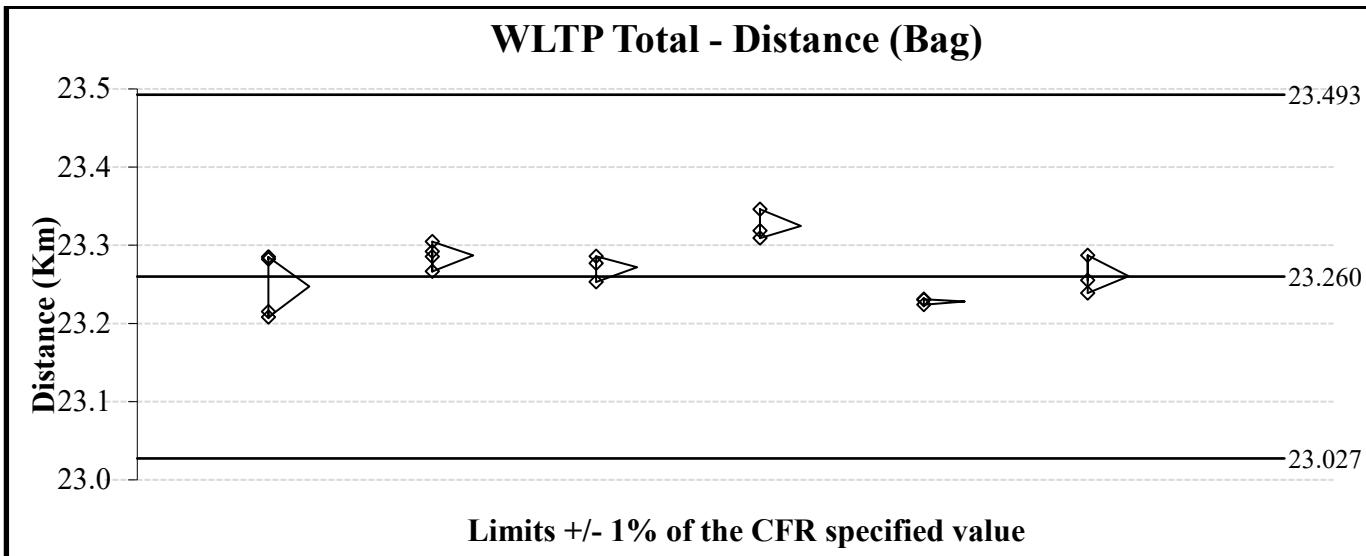
Total (PEMS)	FCA_CPG	Ford	GM	EPA	FCA_CPG_conf	ECCC
Mean	10.87	10.15	10.09	10.09	10.56	10.81
Std Dev	0.1155	0.1732	0.1561	0.16	0.1493	0.1599
CV	1.0626	1.7065	1.5474	1.62	1.4141	1.4797
%Diff to All PEMS Mean	4.3596	-2.5230	-3.1217	-3.07	1.4145	3.7791
%Diff to All Bag Mean	8.8019	1.6264	1.0022	1.06	5.7315	8.1967
T-test to All Bag Mean	Difference	No Difference	No Difference	No Difference	Difference	Difference

Figure 7 – WLTP Bag, Modal and PEMS CBFE



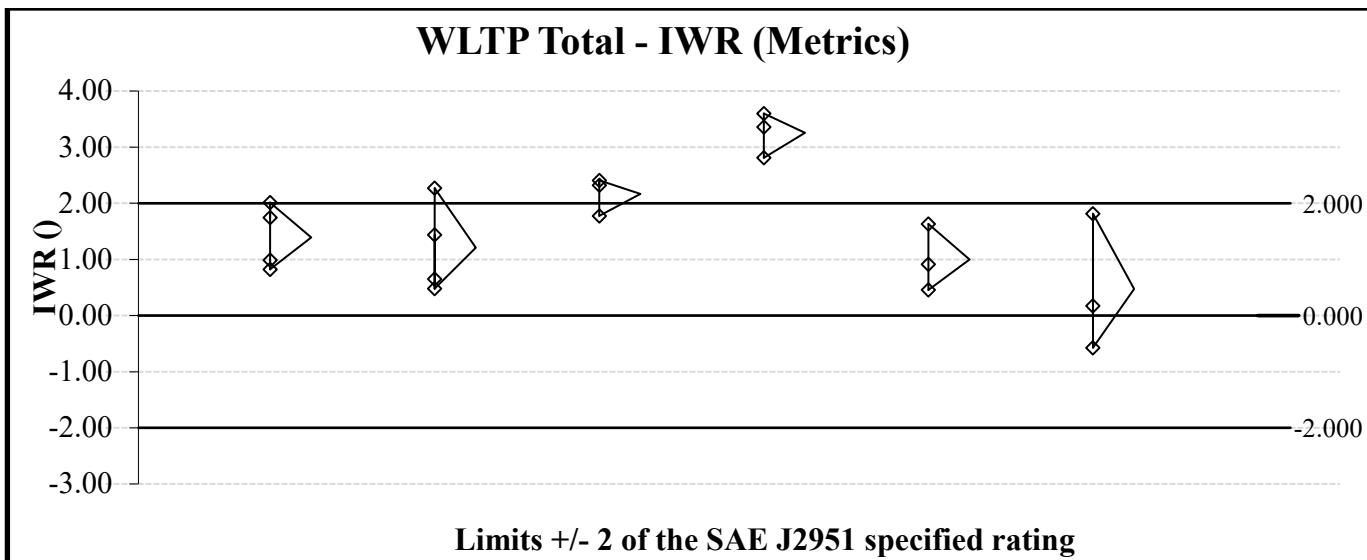
Total (PEMS)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	905.0000	---	822.3548	821.9552	842.5333	925.6333
Std Dev	19.8008	---	14.4373	9.18	0.4041	33.8308
CV	2.1879	---	1.7556	1.12	0.0480	3.6549
%Diff to All PEMS Mean	4.8066	---	-4.7644	-4.81	-2.4276	7.1961
T-test to All PEMS Mean	No Difference	---	No Difference	No Difference	No Difference	No Difference

Figure 8 –PEMS Exh Flow



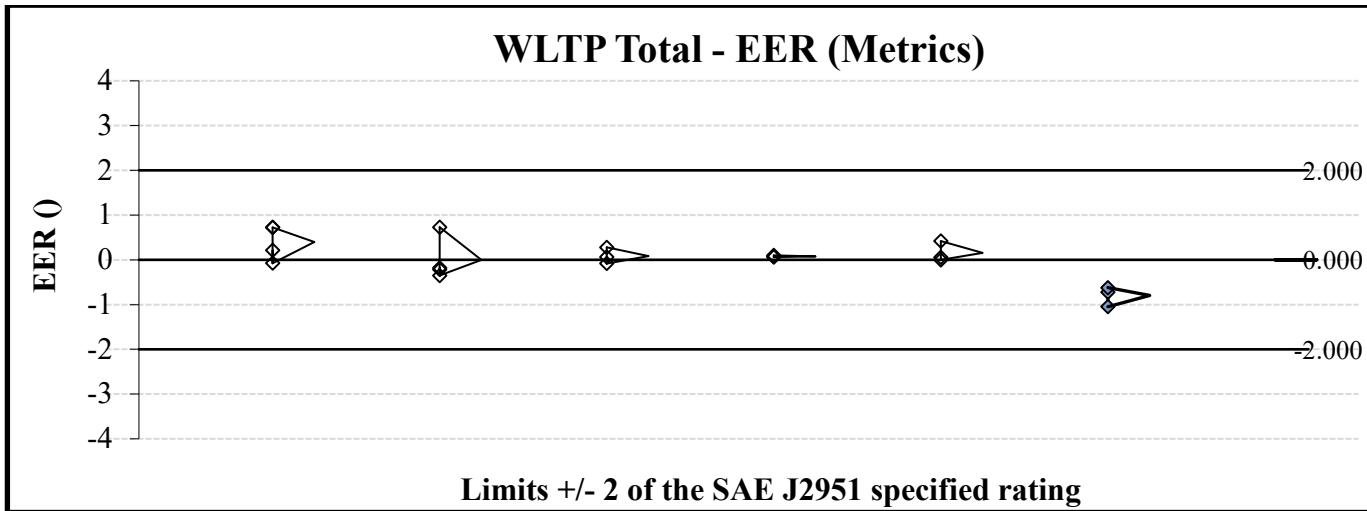
Total (Bag)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	23.248	23.287	23.272	23.325	23.228	23.260
Std Dev	0.0417	0.0159	0.0171	0.02	0.0038	0.0246
CV	0.1793	0.0683	0.0733	0.08	0.0163	0.1057
%Diff to All Bag Mean	-0.0955	0.0748	0.0098	0.24	-0.1779	-0.0404
T-test to All Bag Mean	No Difference	No Difference	No Difference	Difference	No Difference	No Difference

Figure 9 – WLTP Distance



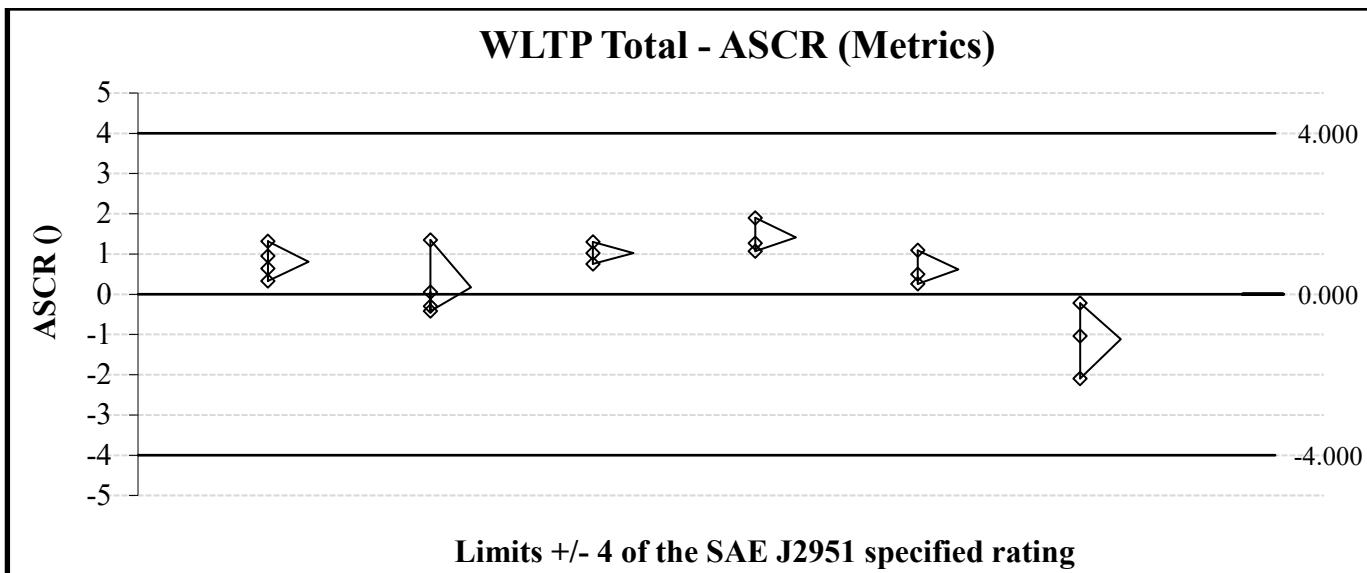
Total (Metrics)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	1.392	1.210	2.169	3.257	1.000	0.471
Std Dev	0.5763	0.8212	0.3431	0.41	0.5928	1.2212
CV	41.4105	67.8660	15.8191	12.44	59.2647	259.1288
%Diff to All Bag Mean	-10.4949	-22.1835	39.4909	109.44	-35.6674	-69.6923
T-test to All Bag Mean	No Difference	No Difference	No Difference	Difference	No Difference	No Difference

Figure 10 –WLTP IWR



Total (Metrics)	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Mean	0.396	-0.005	0.085	0.077	0.158	-0.797
Std Dev	0.3962	0.4953	0.1834	0.02	0.2279	0.2236
CV	99.9962	-9906.9000	215.7501	27.15	144.5620	-28.0545
%Diff to All Bag Mean	5917.4639	-175.9301	1190.8125	1064.26	2294.3305	-12204.7836
T-test to All Bag Mean	No Difference					

Figure 11 – WLTP EER



Total (Metrics)	FCA_CPG	Ford	GM	EPA	FCA_CPG conf	ECCC
Mean	0.808	0.170	1.025	1.413	0.615	-1.118
Std Dev	0.4220	0.8115	0.2730	0.43	0.4289	0.9378
CV	52.2660	477.3775	26.6363	30.65	69.7447	-83.9075
%Diff to All Bag Mean	66.2001	-65.0105	110.9661	190.89	26.5797	-330.0251
T-test to All Bag Mean	No Difference					

Figure 12 – FTP ASCR

Span Gas Concentrations

	NO2 (ppm)	NO (ppm)	HC (ppmC)	CO (%)	CO2 (%)
EPA	250.4	2406	2717.1	0.1286 %	12.90 %
Ford		2743		9.25 %	15.63 %
GM	103.2	1529	299.5	1.02 %	15.88 %
FCA_CPG	249.9	1390	896.4	0.1228 %	16.07 %
ECCC	255.1	1491	24.8	1.255%	12.4 %

Table 1 – Span Gas Concentrations

	PEMS Make/Model
EPA	Sensors / LDV
Ford	Horiba / OBS-ONE
GM	Sensors / LDV
FCA_CPG	Sensors / LDV
ECCC	Sensors / LDV

Table 2 – PEMS Make and model

Dynamometer Load Curves

Target	FCA_CPG	Ford	GM	EPA	FCA_CPG_conf	ECCC
38.24	19.12	19.1	17.78	19.12	17.26	17.66
0.2803	0.0561	0.0561	0.0048	0.0561	0.1723	0.0531
0.02328	0.02328	0.02328	0.02328	0.02328	0.02209	0.02356

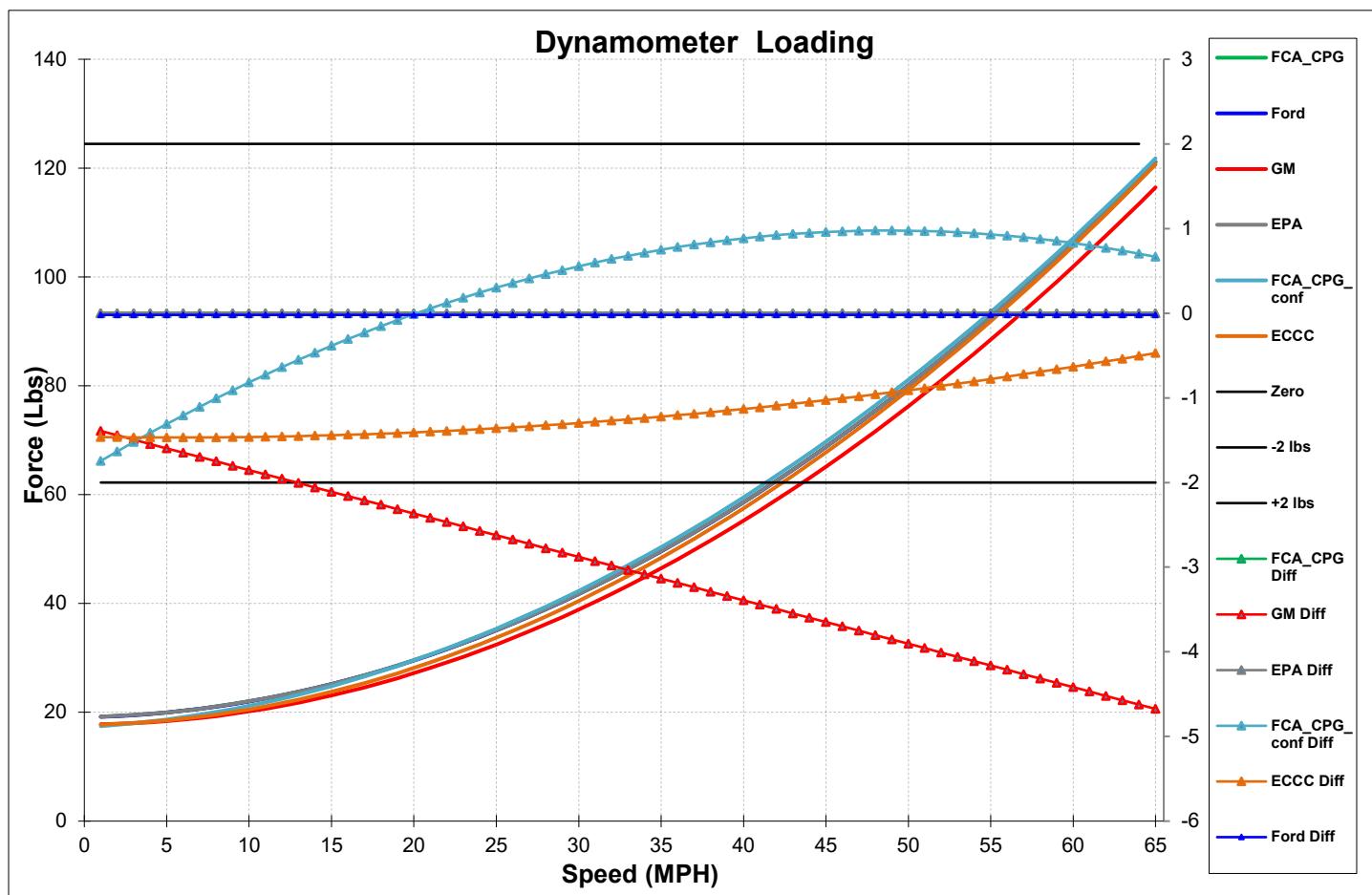


Figure 13 – Dynamometer Curve Comparison

Fuel Properties Summary

Tier III E10 Gasoline

	Units	-	FCA CPG	Ford	GM	EPA	FCA CPG conf	ECCC
Carbon Weight Fraction	btu/lb	Ratio	0.8250	0.8303	0.8270	0.8300	0.8250	0.8419
Net Heating Value			17973	17955	17804	18037	17994	17786
Specific Gravity			0.753	0.749	0.744	0.744	0.746	0.747
RVP			7.2	8.7	9.2	9.0	9.2	8.8

*LEV III fuel was used for CPG baseline test

Table 3 – Fuel Properties

WLTP Data

DATE	CELL	Total (Bag)								Total (Metrics)		
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	Consump L/100Km	Distance Km	IWR	EER	ASCR
Bag Data												
All Bag Mean		0.0210	0.210	0.0044	227.2	0.0185	0.0025	9.99	23.270	1.555	0.007	0.486
Std Dev		0.0106	0.096	0.0013	3.83	0.0102	0.0005	0.19	0.037	1.0789	0.466	0.9512
CV		50.43	45.73	30.52	1.68	54.80	19.02	1.95	0.16	69.38	7077.09	195.77
FCA_CPG												
4/1/2019	7	0.0217	0.2228	0.0049	232.1	0.0192	0.0026	10.14	23.282	1.745	0.725	0.948
4/2/2019	7	0.0195	0.2230	0.0059	230.1	0.0171	0.0026	10.06	23.285	2.012	0.722	1.315
4/3/2019	7	0.0226	0.2078	0.0056	231.5	0.0200	0.0027	10.14	23.208	0.824	-0.077	0.330
4/4/2019	7	0.0209	0.2246	0.0051	230.5	0.0182	0.0028	10.09	23.215	0.986	0.215	0.637
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0195	0.208	0.005	230.1	0.0171	0.0026	10.06	23.208	0.8240	-0.08	0.330
Mean		0.0212	0.220	0.0054	231.0	0.0186	0.0027	10.11	23.248	1.392	0.40	0.808
Max		0.0226	0.225	0.0059	232.1	0.0200	0.0028	10.14	23.285	2.0120	0.73	1.3150
Std Dev		0.0013	0.008	0.0005	0.91	0.0013	0.0001	0.04	0.042	0.5763	0.40	0.4220
CV		6.17	3.58	8.80	0.39	6.79	4.48	0.40	0.18	41.41	100.00	52.27
%Diff to All Bag Mean		1.04	4.74	22.37	1.68	0.55	5.74	1.23	-0.10	-10.49	5917.46	66.20
Ford												
4/17/2019	0	0.0178	0.1447	0.0023	228.5	0.0155	0.0023	10.07	23.30	2.270	0.730	1.350
4/18/2019	0	0.0173	0.1409	0.0005	224.8	0.0160	0.0023	9.90	23.29	0.480	-0.220	-0.420
4/24/2019	0	0.0157	0.1615	0.0036	222.2	0.0134	0.0024	9.79	23.27	0.650	-0.350	-0.300
4/26/2019	0	0.0175	0.1521	0.0044	222.1	0.0151	0.0024	9.79	23.29	1.440	-0.180	0.050
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0157	0.141	0.0005	222.1	0.0134	0.0023	9.79	23.267	0.4800	-0.350	-0.420
Mean		0.0171	0.150	0.0027	224.4	0.0150	0.0024	9.89	23.287	1.2100	-0.005	0.1700
Max		0.0178	0.161	0.0044	228.5	0.0160	0.0024	10.07	23.305	2.2700	0.730	1.3500
Std Dev		0.0009	0.009	0.0017	3.02	0.0011	0.0001	0.13	0.016	0.8212	0.495	0.8115
CV		5.50	6.06	63.80	1.35	7.58	3.19	1.34	0.07	67.87	-9906.90	477.38
%Diff to All Bag Mean		-18.60	-28.55	-38.67	-1.24	-19.30	-6.45	-1.02	0.07	-22.18	-175.93	-65.01
GM												
5/1/2019	0	0.0216	0.203	0.0057	231.0	0.0188	0.0028	10.26	23.286	2.322	0.059	1.300
5/2/2019	0	0.0231	0.203	0.0049	225.2	0.0205	0.0026	10.00	23.277	2.409	-0.084	1.021
5/3/2019	0	0.0255	0.230	0.0054	225.2	0.0224	0.0034	10.00	23.253	1.776	0.280	0.754
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0216	0.203	0.0049	225.2	0.0188	0.0026	10.0	23.253	1.7760	-0.084	0.754
Mean		0.0234	0.2116	0.0053	227.1	0.0206	0.0029	10.08	23.272	2.1690	0.085	1.0250
Max		0.0255	0.230	0.0057	231.0	0.0224	0.0034	10.3	23.286	2.4090	0.280	1.3000
Std Dev		0.0020	0.0156	0.0004	3.36	0.0018	0.0004	0.15	0.017	0.3431	0.183	0.2730
CV		8.45	7.39	7.90	1.48	8.70	12.74	1.47	0.07	15.82	215.75	26.64
%Diff to All Bag Mean		11.80	0.96	21.37	-0.04	11.01	16.54	0.97	0.01	39.49	1190.81	110.97
EPA												
5/15/2019	0	0.0603	0.593	0.0056	234.8	0.0565	0.0037	10.32	23.309	3.600	0.100	1.900
5/16/2019	0	0.0280	0.247	0.0031	230.9	0.0249	0.0031	10.12	23.346	3.360	0.060	1.270
5/29/2019	0	0.0193	0.150	0.0050	226.5	0.0168	0.0025	9.92	23.319	2.810	0.070	1.070
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0193	0.150	0.0031	226.5	0.0168	0.002	9.92	23.309	2.8100	0.060	1.070
Mean		0.0358	0.330	0.0046	230.7	0.0327	0.0031	10.12	23.325	3.2567	0.077	1.4133
Max		0.0603	0.593	0.0056	234.8	0.0565	0.004	10.32	23.346	3.6000	0.100	1.9000
Std Dev		0.0216	0.233	0.0013	4.13	0.0210	0.001	0.20	0.019	0.4050	0.021	0.4332
CV		60.30	70.44	28.39	1.79	64.23	20.00	1.96	0.08	12.44	27.15	30.65
%Diff to All Bag Mean		71.03	57.51	3.89	1.53	76.53	23.16	1.30	0.24	109.44	1064.26	190.89
FCA_CPG_conf												
6/10/2019	7	0.0132	0.167	0.0043	226.7	0.0113	0.0020	9.97	23.230	0.456	0.000	0.256
6/11/2019	7	0.0128	0.168	0.0045	227.5	0.0111	0.0019	9.99	23.231	0.913	0.054	0.499
6/12/2019	7	0.0133	0.161	0.0045	226.3	0.0115	0.0020	9.94	23.224	1.632	0.419	1.090
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0128	0.161	0.0043	226.3	0.0111	0.0019	9.94	23.224	0.4560	0.000	0.256
Mean		0.0131	0.165	0.0044	226.8	0.0113	0.0019	9.97	23.228	1.003	0.158	0.6150
Max		0.0133	0.168	0.0045	227.5	0.0115	0.0020	9.99	23.231	1.6320	0.419	1.0900
Std Dev		0.0003	0.004	0.0001	0.60	0.0002	0.0001	0.03	0.004	0.5928	0.228	0.4289
CV		1.96	2.42	2.07	0.27	1.86	3.66	0.28	0.02	59.26	144.56	69.74
%Diff to All Bag Mean		-37.41	-21.06	1.00	-0.18	-39.19	-23.23	-0.21	-0.18	-35.67	2294.33	26.58
ECCC												
9/13/2019	0	0.0234	0.195	0.0055	223.1	0.0212	0.0022	9.89	23.239	-0.572	-1.049	-2.093
9/17/2019	0	0.0200	0.179	0.0038	220.8	0.0180	0.0020	9.40	23.287	0.172	-0.722	-1.038
9/19/2019	0	0.0056	0.220	0.0033	225.0	0.0034	0.0021	9.97	23.255	1.814	-0.621	-0.222
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	-0.5724	-1.049	-2.093
Min		0.0056	0.179	0.0033	220.8	0.0034	0.0020	9.40	23.239	-0.5724	-1.049	-2.093
Mean		0.0163	0.198	0.0042	222.9	0.0142	0.0021	9.75	23.260	0.4713	-0.797	-1.1176
Max		0.0234	0.220	0.0055	225.0	0.0212	0.0022	9.97	23.287	1.8143	-0.621	-0.2223
Std Dev		0.0095	0.021	0.0011	2.08	0.0095	0.0001	0.31	0.025	1.2212	0.224	0.9378
CV		58.04	10.50	27.27	0.93	66.66	5.28	3.16	0.11	259.13	-28.05	-83.91
%Diff to All Bag Mean		-22.00	-5.67	-4.53	-1.89	-23.35	-15.53	-2.34	-0.04	-69.69	-12204.78	-330.03

Table 4 – WLTP Total Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 1 Data

DATE	CELL	Phase1 (Bag)								Phase1 (Metrics)		
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	I Consump L/100Km	Distance Km	IWR	EER	ASCR
Bag Data												
All Bag Mean		0.1299	0.848	0.0114	381.9	0.1120	0.0126	16.50	3.103	-0.357	-0.491	-0.474
Std Dev		0.077	0.335	0.0059	10.0	0.0791	0.0030	1.61	0.013	1.4813	1.064	1.1053
CV		59.20	39.52	52.19	2.63	70.61	23.92	9.75	0.43	-415.20	-216.65	-233.02
FCA_CPG												
4/1/2019	7	0.1367	0.971	0.0153	388.3	0.1241	0.0132	17.05	3.100	0.081	0.599	-0.039
4/2/2019	7	0.1233	0.978	0.0254	384.7	0.1107	0.0133	16.89	3.105	0.996	0.923	0.565
4/3/2019	7	0.1429	0.995	0.0182	398.6	0.1299	0.0136	17.49	3.082	0.278	0.016	0.086
4/4/2019	7	0.1304	1.023	0.0157	382.1	0.1168	0.0143	16.78	3.084	-0.825	-0.353	-0.632
T-test to All Bag Mean		No Diff	No Diff	Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.1233	0.971	0.0153	382.1	0.1107	0.0132	16.78	3.082	-0.8250	-0.353	-0.632
Mean		0.1333	0.992	0.0186	388.4	0.1204	0.0136	17.05	3.093	0.133	0.296	-0.005
Max		0.1429	1.023	0.0254	398.6	0.1299	0.0143	17.49	3.105	0.9960	0.923	0.5650
Std Dev		0.0084	0.023	0.0047	7.21	0.0084	0.0005	0.31	0.011	0.7497	0.573	0.4924
CV		6.29	2.34	25.19	1.86	6.98	3.50	1.82	0.37	565.83	193.37	-9848.63
%Diff to All Bag Mean		2.64	16.90	64.13	1.70	7.48	8.12	3.34	-0.35	-137.14	-160.30	-98.95
Ford												
4/17/2019	0	0.1099	0.6663	0.0018	386.7700	0.0994	0.0105	17.03	3.120	0.000	0.000	0.000
4/18/2019	0	0.1079	0.6474	0.0004	379.6900	0.0968	0.0111	16.72	3.109	0.000	0.000	0.000
4/24/2019	0	0.0943	0.6302	0.0077	373.8800	0.0825	0.0117	9.99	3.096	0.000	0.000	0.000
4/26/2019	0	0.0997	0.5729	0.0088	366.9300	0.0889	0.0107	16.16	3.111	0.000	0.000	0.000
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0943	0.573	0.0004	366.9	0.0825	0.0105	9.99	3.096	0.0000	0.000	0.000
Mean		0.1030	0.629	0.0047	376.8	0.0919	0.0110	14.97	3.109	0.0000	0.000	0.0000
Max		0.1099	0.666	0.0088	386.8	0.0994	0.0117	17.03	3.120	0.0000	0.000	0.000
Std Dev		0.007	0.040	0.0042	8.44	0.0077	0.0005	3.34	0.010	0.0000	0.000	0.000
CV		7.07	6.41	89.40	2.24	8.33	4.69	22.31	0.33	---	---	---
%Diff to All Bag Mean		-20.72	-25.83	-58.89	-1.34	-17.96	-12.56	-9.26	0.18	-100.00	-100.00	-100.00
GM												
5/1/2019	0	0.1260	0.758	0.0130	402.6	0.0010	0.0130	17.91	3.112	3.020	0.850	1.590
5/2/2019	0	0.1470	0.940	0.0130	381.5	0.1330	0.0140	16.99	3.105	0.750	0.170	0.480
5/3/2019	0	0.1570	1.034	0.0160	381.8	0.1420	0.0150	17.01	3.093	-0.290	-0.230	-0.690
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.1260	0.758	0.0130	381.5	0.0010	0.0130	16.99	3.093	-0.2900	-0.230	-0.690
Mean		0.1433	0.911	0.0140	388.6	0.0920	0.0140	17.30	3.103	1.1600	0.263	0.4600
Max		0.1570	1.034	0.0160	402.6	0.1420	0.0150	17.91	3.112	3.0200	0.850	1.5900
Std Dev		0.0158	0.140	0.0017	12.10	0.0789	0.0010	0.53	0.010	1.6927	0.546	1.1401
CV		11.04	15.41	12.37	3.11	85.80	7.14	3.04	0.31	145.92	207.35	247.85
%Diff to All Bag Mean		10.37	7.36	23.31	1.75	-17.86	11.36	4.85	-0.01	-425.14	-153.60	-196.98
EPA												
5/15/2019	0	0.4182	1.879	0.0193	402.5	0.3977	0.0211	17.79	3.108	0.910	-0.650	-0.080
5/16/2019	0	0.1883	1.186	0.0087	383.0	0.1740	0.0155	16.85	3.120	0.060	-1.250	-0.800
5/29/2019	0	0.1218	0.674	0.0106	368.6	0.1100	0.0124	16.18	3.125	-0.680	-1.770	-1.080
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.1212	0.6742	0.009	368.6	0.1100	0.0124	16.1770	3.108	-0.6800	-1.770	-1.080
Mean		0.243	1.2465	0.013	384.7	0.2272	0.016	16.94	3.118	0.0967	-1.223	-0.6533
Max		0.418	1.8791	0.019	402.5	0.3977	0.021	17.79	3.125	0.9100	-0.650	-0.0800
Std Dev		0.156	0.6047	0.006	17.1	0.1511	0.0044	0.81	0.009	0.7956	0.560	0.5159
CV		64.07	48.51	43.91	4.43	66.48	26.94	4.79	0.29	823.07	-45.82	-78.96
%Diff to All Bag Mean		86.92	46.95	13.11	0.72	102.87	30.16	2.65	0.46	-127.09	148.99	37.74
FCA_CPG_conf												
6/10/2019	7	0.0743	0.387	0.0116	380.8	0.0663	0.0084	16.75	3.085	-0.572	-0.077	-0.116
6/11/2019	7	0.0749	0.4942	0.0086	379.0	0.0674	0.0080	16.6789	3.0880	-0.797	-0.189	-0.470
6/12/2019	7	0.0721	0.4199	0.0096	376.6	0.0647	0.0078	16.5643	3.0920	-1.068	-0.666	-0.471
T-test to All Bag Mean		No Diff	Diff	No Diff	No Diff	No Diff	Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0721	0.387	0.0086	376.6	0.0647	0.0078	16.56	3.0850	-1.0680	-0.666	-0.471
Mean		0.0738	0.434	0.0099	378.8	0.0662	0.0080	16.67	3.088	-0.8123	-0.311	-0.3523
Max		0.0749	0.494	0.0116	380.8	0.0674	0.0084	16.75	3.092	-0.5720	-0.077	-0.1160
Std Dev		0.0015	0.055	0.0015	2.12	0.0013	0.0003	0.10	0.004	0.2484	0.313	0.2047
CV		2.04	12.71	15.40	0.56	2.03	4.14	0.57	0.11	-30.57	-100.68	-58.09
%Diff to All Bag Mean		-43.19	-48.89	-12.72	-0.83	-40.94	-36.10	0.99	-0.49	127.69	-36.77	-25.72
ECCC												
9/13/2019	0	0.1348	0.844	0.0099	374.3	0.1230	0.0118	16.64	3.106	-3.857	-2.139	-3.212
9/17/2019	0	0.1162	0.759	0.0087	372.4	0.1044	0.0118	15.89	3.106	-3.353	-3.316	-2.809
9/19/2019	0	0.0217	1.107	0.0050	374.8	0.0075	0.0143	16.69	3.122	-1.789	-1.745	-1.808
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	DifF	DifF	DifF	DifF
Min		0.0217	0.759	0.0050	372.4	0.0075	0.0118	15.89	3.106	-3.8567	-3.316	-3.212
Mean		0.0909	0.903	0.0079	373.8	0.0783	0.0126	16.41	3.111	-2.9995	-2.400	-2.6098
Max		0.1348	1.107	0.0099	374.8	0.1230	0.0143	16.69	3.122	-1.7886	-1.745	-1.8078
Std Dev		0.00606	0.181	0.0026	1.3	0.0621	0.0014	0.45	0.01	1.0784	0.817	0.7232
CV		66.68	20.07	32.87	0.34	79.25	11.36	2.73	0.30	-35.95	-34.05	-27.71
%Diff to All Bag Mean		-29.99	6.49	-30.68	-2.12	-30.10	0.50	-0.58	0.25	740.73	388.44	450.22

Table 5 - WLTP Phase1 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 2 Data

DATE	CELL	Phase2 (Bag)								Phase2 (Metrics)		
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	l Consump L/100Km	Distance Km	IWR	EER	ASCR
Bag Data												
All Bag Mean		0.0009	0.064	0.004	230.7	0.0004	0.0005	10.04	4.755	1.266	0.201	0.737
Std Dev		0.0003	0.022	0.001	3.7	0.0004	0.0003	0.45	0.011	1.6202	0.780	1.2486
CV		36.45	33.98	38.28	1.62	93.77	58.48	4.51	0.24	127.95	388.55	169.52
FCA_CPG												
4/1/2019	7	0.0012	0.078	0.0042	236.1	0.0006	0.0006	10.32	4.759	1.411	0.909	0.894
4/2/2019	7	0.0009	0.088	0.0035	234.1	0.0002	0.0007	10.24	4.759	2.068	0.955	1.491
4/3/2019	7	0.0010	0.061	0.0038	235.6	0.0002	0.0008	10.29	4.743	0.122	-0.474	0.229
4/4/2019	7	0.0008	0.053	0.0038	234.1	0.0003	0.0006	10.24	4.745	1.278	0.752	1.490
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0008	0.053	0.0035	234.1	0.0002	0.0006	10.24	4.743	0.122	-0.474	0.229
Mean		0.0010	0.070	0.0038	234.9	0.0003	0.0007	10.27	4.752	1.220	0.536	1.026
Max		0.0012	0.088	0.0042	236.1	0.0006	0.0008	10.32	4.759	2.068	0.955	1.491
Std Dev		0.0002	0.016	0.0003	1.02	0.0002	0.0001	0.04	0.009	0.8092	0.679	0.6012
CV		18.55	22.79	6.80	0.43	57.98	14.72	0.40	0.18	66.34	126.72	58.59
%Diff to All Bag Mean		4.69	8.90	1.49	1.84	-13.30	29.32	2.29	-0.08	-3.68	166.84	39.30
Ford												
4/17/2019	0	0.0011	0.047	0.0000	231.8	0.0005	0.0006	10.21	4.762	0.000	0.000	0.000
4/18/2019	0	0.0012	0.032	0.0000	227.0	0.0008	0.0004	10.00	4.749	0.000	0.000	0.000
4/24/2019	0	0.0002	0.068	0.0043	226.8	0.0000	0.0008	8.27	4.759	0.000	0.000	0.000
4/26/2019	0	0.0007	0.057	0.0045	226.7	0.0001	0.0005	9.99	4.768	0.000	0.000	0.000
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0002	0.032	0.0000	226.7	0.0000	0.0004	8.27	4.749	0.0000	0.000	0.000
Mean		0.0008	0.051	0.0022	228.1	0.0004	0.0006	9.62	4.760	0.0000	0.000	0.0000
Max		0.0012	0.068	0.0045	231.8	0.0008	0.0008	10.21	4.768	0.0000	0.000	0.0000
Std Dev		0.0005	0.0152	0.0025	2.45	0.0004	0.0001	0.90	0.008	0.0000	0.000	0.0000
CV		58.05	29.78	115.54	1.08	99.98	24.45	9.41	0.16	---	---	---
%Diff to All Bag Mean		-14.08	-20.65	-41.77	-1.14	-6.88	8.55	-4.25	0.09	-100.00	-100.00	-100.00
GM												
5/1/2019	0	0.0010	0.067	0.0050	232.8	0.0000	0.0010	10.32	4.763	2.230	0.590	0.970
5/2/2019	0	0.0010	0.091	0.0050	225.0	0.0010	0.0000	9.98	4.761	1.370	0.070	0.320
5/3/2019	0	0.0010	0.053	0.0050	226.9	0.0000	0.0010	10.06	4.757	2.070	0.750	1.260
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0010	0.053	0.0050	225.0	0.0000	0.0000	9.98	4.757	1.3700	0.070	0.320
Mean		0.0010	0.070	0.0050	228.2	0.0003	0.0007	10.12	4.760	1.8900	0.470	0.8500
Max		0.0010	0.091	0.0050	232.8	0.0010	0.0010	10.32	4.763	2.2300	0.750	1.2600
Std Dev		0.0000	0.019	0.0000	4.07	0.0006	0.0006	0.18	0.003	0.4574	0.356	0.4814
CV		0.00	27.32	0.00	1.78	173.21	86.60	1.76	0.06	24.20	75.64	56.63
%Diff to All Bag Mean		5.75	9.13	32.50	-1.07	-14.37	25.86	0.76	0.11	49.25	134.20	15.40
EPA												
5/15/2019	0	0.0012	0.094	0.0037	236.6	0.0006	0.0006	10.36	4.762	6.150	1.450	4.040
5/16/2019	0	0.0012	0.066	0.0025	230.5	0.0000	0.0006	10.09	4.764	2.090	-0.160	1.350
5/29/2019	0	0.0012	0.027	0.0037	228.5	0.0000	0.0006	10.00	4.760	3.680	1.280	2.260
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.001	0.0273	0.002	228.5	0.0000	0.001	10.00	4.760	2.0900	-0.160	1.350
Mean		0.001	0.0623	0.003	231.9	0.0002	0.001	10.15	4.762	3.9733	0.857	2.5500
Max		0.001	0.0938	0.004	236.6	0.0006	0.001	10.36	4.764	6.1500	1.450	4.0400
Std Dev		0.0000	0.0334	0.001	4.24	0.0004	0.000	0.19	0.002	2.0458	0.885	1.3682
CV		0.00	53.55	21.65	1.83	173.21	0.00	1.85	0.03	51.49	103.26	53.66
%Diff to All Bag Mean		31.43	-3.26	-12.18	0.50	-46.79	17.31	1.03	0.14	213.78	326.88	246.21
FCA_CPG_conf												
6/10/2019	7	0.0010	0.087	0.0044	232.1	0.0006	0.0005	10.18	4.749	0.259	0.016	0.521
6/11/2019	7	0.0010	0.103	0.0037	233.9	0.0005	0.0005	10.26	4.741	0.846	0.105	1.011
6/12/2019	7	0.0012	0.076	0.0046	232.7	0.0005	0.0007	10.23	4.743	1.625	1.041	1.678
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	Dif	No Diff	No Diff	No Diff	No Diff
Min		0.0010	0.076	0.0037	232.1	0.0005	0.0005	10.18	4.7410	0.2590	0.016	0.521
Mean		0.0010	0.089	0.0043	232.9	0.0005	0.0006	10.22	4.744	0.9100	0.387	1.0700
Max		0.0012	0.103	0.0046	233.9	0.0006	0.0007	10.26	4.749	1.6250	1.041	1.6780
Std Dev		0.0001	0.014	0.0005	0.92	0.0001	0.0001	0.04	0.004	0.6852	0.568	0.5808
CV		10.40	15.49	10.98	0.39	10.58	23.64	0.41	0.09	75.30	146.60	54.28
%Diff to All Bag Mean		9.63	37.50	12.62	0.95	28.44	6.35	1.79	-0.23	-28.14	93.01	45.27
ECCC												
9/13/2019	0	0.0000	0.034	0.0050	227.7	0.0000	0.0000	10.08	4.748	-1.499	-1.103	-2.198
9/17/2019	0	0.0006	0.067	0.0050	225.4	0.0006	0.0000	9.59	4.780	1.107	-0.590	0.008
9/19/2019	0	0.0012	0.039	0.0037	229.9	0.0012	0.0000	10.17	4.731	0.519	-1.577	-0.593
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	Dif	No Diff	No Diff	No Diff	Dif	No Diff	No Diff
Min		0.0000	0.034	0.0037	225.4	0.0000	0.0000	9.59	4.731	-1.4986	-1.577	-2.198
Mean		0.0006	0.047	0.0046	227.7	0.0006	0.0000	9.95	4.753	0.0423	-1.090	-0.9277
Max		0.0012	0.067	0.0050	229.9	0.0012	0.0000	10.17	4.780	1.1065	-0.590	0.0077
Std Dev		0.0006	0.018	0.0007	2.2	0.0006	0.0000	0.31	0.025	1.3664	0.493	1.1404
CV		100.00	38.39	15.75	0.98	100.00	---	3.14	0.52	3230.28	-45.27	-122.92
%Diff to All Bag Mean		-34.29	-27.69	20.75	-1.31	59.62	-100.00	-0.97	-0.05	-96.66	-643.22	-225.96

Table 6 - WLTP Phase2 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 3 Data

DATE	CELL	Phase3 (Bag)								Phase3 (Metrics)		
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	e1 Consumpt L/100Km	Distance Km	IWR	EER	ASCR
Bag Data												
All Bag Mean		0.0009	0.068	0.0027	185.9	0.0006	0.0004	8.17	7.159	1.917	0.005	0.733
Std Dev		0.0010	0.025	0.0009	4.2	0.0011	0.0003	0.20	0.012	1.8070	0.681	1.3625
CV		107.41	37.28	31.84	2.24	190.12	70.49	2.50	0.16	94.24	14109.10	185.84
FCA_CPG												
4/1/2019	7	0.0011	0.098	0.0026	192.2	0.0007	0.0004	8.40	7.165	3.755	1.182	2.278
4/2/2019	7	0.0007	0.090	0.0025	190.3	0.0004	0.0003	8.31	7.164	1.998	0.598	1.124
4/3/2019	7	0.0005	0.061	0.0026	188.4	0.0002	0.0003	8.23	7.139	1.676	-0.424	0.414
4/4/2019	7	0.0007	0.095	0.0024	190.6	0.0002	0.0005	8.34	7.142	2.175	0.515	1.296
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0005	0.061	0.0024	188.4	0.0002	0.0003	8.23	7.139	1.676	-0.424	0.414
Mean		0.0007	0.086	0.0025	190.4	0.0004	0.0004	8.32	7.153	2.401	0.468	1.278
Max		0.0011	0.098	0.0026	192.2	0.0007	0.0005	8.40	7.165	3.755	1.182	2.278
Std Dev		0.0002	0.017	0.0001	1.55	0.0002	0.0001	0.07	0.014	0.9260	0.664	0.7682
CV		33.19	19.67	4.01	0.82	63.01	22.18	0.83	0.19	38.57	142.06	60.11
%Diff to All Bag Mean		-22.41	26.97	-7.25	2.39	-35.31	-9.63	1.90	-0.09	25.22	9594.30	74.31
Ford												
4/17/2019	0	0.0005	0.031	0.0036	187.7	0.0000	0.0005	8.27	7.170	0.000	0.000	0.000
4/18/2019	0	0.0007	0.029	0.0000	183.8	0.0004	0.0003	8.10	7.168	0.000	0.000	0.000
4/24/2019	0	0.0007	0.071	0.0023	181.9	0.0003	0.0004	8.02	7.166	0.000	0.000	0.000
4/26/2019	0	0.0004	0.046	0.0025	181.2	0.0001	0.0003	7.99	7.156	0.000	0.000	0.000
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	Diff	No Diff	No Diff
Min		0.0004	0.029	0.0000	181.2	0.0000	0.0003	7.99	7.156	0.0000	0.000	0.000
Mean		0.0005	0.044	0.0021	183.6	0.0002	0.0004	8.09	7.165	0.0000	0.000	0.0000
Max		0.0007	0.071	0.0036	187.7	0.0004	0.0005	8.27	7.170	0.0000	0.000	0.000
Std Dev		0.0001	0.020	0.0015	2.89	0.0002	0.0001	0.13	0.006	0.0000	0.000	0.000
CV		26.47	44.46	72.50	1.57	99.45	26.15	1.57	0.09	---	---	---
%Diff to All Bag Mean		-42.53	-34.67	-22.89	-1.23	-69.98	-9.63	-0.90	0.08	-100.00	-100.00	-100.00
GM												
5/1/2019	0	0.0010	0.083	0.0040	190.5	0.0010	0.0010	8.45	7.166	3.520	0.270	1.790
5/2/2019	0	0.0010	0.048	0.0030	185.5	0.0000	0.0000	8.22	7.164	3.860	0.070	1.770
5/3/2019	0	0.0000	0.058	0.0030	183.8	0.0000	0.0010	8.15	7.159	2.220	0.450	1.210
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0000	0.048	0.0030	183.8	0.0000	0.0000	8.15	7.159	2.2200	0.070	1.210
Mean		0.0007	0.063	0.0033	186.6	0.0003	0.0007	8.27	7.163	3.2000	0.263	1.5900
Max		0.0010	0.083	0.0040	190.5	0.0010	0.0010	8.45	7.166	3.8600	0.450	1.7900
Std Dev		0.0001	0.018	0.0006	3.48	0.0001	0.0001	0.16	0.004	0.8656	0.190	0.3292
CV		86.60	28.62	17.32	1.87	173.21	86.60	1.90	0.05	27.05	72.19	20.71
%Diff to All Bag Mean		-29.38	-7.14	22.69	0.37	-43.63	61.73	1.32	0.05	66.89	5357.69	116.87
EPA												
5/15/2019	0	0.0006	0.070	0.0025	188.7	0.0000	0.0006	8.26	7.179	4.370	0.050	2.370
5/16/2019	0	0.0006	0.081	0.0025	189.2	0.0000	0.0006	8.28	7.181	4.880	0.810	2.530
5/29/2019	0	0.0006	0.047	0.0025	185.1	0.0000	0.0006	8.10	7.165	2.310	-0.250	1.160
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0001	0.0466	0.002	185.1	0.0000	0.0001	8.0996	7.165	2.3100	-0.250	1.160
Mean		0.0001	0.0661	0.002	187.7	0.0000	0.001	8.21	7.175	3.8533	0.203	2.0200
Max		0.0001	0.0814	0.002	189.2	0.0000	0.0001	8.28	7.181	4.8800	0.810	2.5300
Std Dev		0.0000	0.0178	0.000	2.24	0.0000	0.000	0.10	0.009	1.3607	0.546	0.7491
CV		0.00	26.89	0.00	1.19	---	0.00	1.21	0.12	35.31	268.71	37.08
%Diff to All Bag Mean		-34.18	-2.61	-8.51	0.95	-100.00	50.75	0.59	0.22	100.97	4114.16	175.52
FCA_CPG_conf												
6/10/2019	7	0.0009	0.089	0.0027	186.9	0.0003	0.0006	8.21	7.151	1.075	-0.244	0.213
6/11/2019	7	0.0006	0.105	0.0042	188.0	0.0003	0.0004	8.27	7.152	1.572	-0.220	0.743
6/12/2019	7	0.0009	0.113	0.0022	186.9	0.0005	0.0005	8.22	7.147	2.704	0.408	1.948
T-test to All Bag Mean		No Diff	Dif	No Diff	No Dif	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0006	0.089	0.0022	186.9	0.0003	0.0004	8.21	7.1470	1.0750	-0.244	0.213
Mean		0.0008	0.102	0.0030	187.3	0.0004	0.0005	8.23	7.150	1.7837	-0.019	0.9680
Max		0.0009	0.113	0.0042	188.0	0.0005	0.0006	8.27	7.152	2.7040	0.408	1.9480
Std Dev		0.0002	0.012	0.0010	0.64	0.0001	0.0001	0.03	0.003	0.8349	0.370	0.8891
CV		19.36	11.48	33.53	0.34	32.98	26.96	0.39	0.04	46.81	-1980.53	91.85
%Diff to All Bag Mean		-13.14	50.71	11.65	0.72	-36.30	13.21	0.83	-0.13	-6.97	-486.87	32.03
ECCC												
9/13/2019	0	0.0019	0.053	0.0037	179.2	0.0019	0.0000	7.93	7.145	-1.483	-2.013	-3.088
9/17/2019	0	0.0050	0.040	0.0031	176.8	0.0050	0.0000	7.52	7.162	-0.314	-1.131	-1.555
9/19/2019	0	0.0006	0.048	0.0025	181.9	0.0006	0.0000	8.05	7.145	4.029	0.025	0.460
T-test to All Bag Mean		No Diff	No Diff	No Diff	Dif	No Diff	Dif	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0006	0.040	0.002	176.8	0.0006	0.0000	7.52	7.145	-1.4830	-2.013	-3.088
Mean		0.0025	0.047	0.0031	179.3	0.0025	0.0000	7.83	7.151	0.7442	-1.040	-1.3943
Max		0.0050	0.053	0.004	181.9	0.0050	0.0000	8.05	7.162	4.0293	0.025	0.4598
Std Dev		0.0022	0.007	0.001	2.6	0.0022	0.0000	0.28	0.009	2.9044	1.022	1.7793
CV		90.14	14.13	20.00	1.42	90.14	---	3.55	0.13	390.26	-98.31	-127.61
%Diff to All Bag Mean		163.28	-30.70	14.35	-3.58	320.33	-100.00	-4.07	-0.12	-61.18	-21644.04	-290.17

Table 7 - WLTP Phase3 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 4 Data

DATE	CELL	Phase4 (Bag)								Phase4 (Metrics)		
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	iConsump L/100Km	Distance Km	IWR	EER	ASCR
Bag Data												
All Bag Mean		0.0091	0.176	0.0037	202.9	0.0074	0.0018	8.91	8.252	1.824	0.056	1.312
Std Dev		0.0020	0.161	0.0012	3.5	0.0018	0.0004	0.17	0.011	1.5011	0.279	1.0465
CV		21.80	91.25	32.36	1.74	24.29	21.07	1.87	0.13	82.31	499.23	79.76
FCA_CPG												
4/1/2019	7	0.0082	0.1340	0.0034	205.6990	0.0067	0.0017	8.9966	8.2580	1.219	0.381	0.876
4/2/2019	7	0.0075	0.1318	0.0029	204.1000	0.0061	0.0015	8.9147	8.2570	2.600	0.660	2.779
4/3/2019	7	0.0092	0.1251	0.0045	204.0660	0.0074	0.0018	8.9145	8.2440	1.012	0.264	0.866
4/4/2019	7	0.0091	0.1365	0.0042	206.4520	0.0073	0.0018	9.0239	8.2440	0.741	-0.108	0.521
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0075	0.125	0.0029	204.1	0.0061	0.0015	8.91	8.244	0.741	-0.108	0.521
Mean		0.0085	0.132	0.0037	205.1	0.0069	0.0017	8.96	8.251	1.393	0.299	1.261
Max		0.0092	0.137	0.0045	206.5	0.0074	0.0018	9.02	8.258	2.600	0.660	2.779
Std Dev		0.0008	0.005	0.0007	1.19	0.0006	0.0002	0.06	0.008	0.8281	0.318	1.0257
CV		9.37	3.71	18.94	0.58	9.23	9.64	0.63	0.09	59.45	106.36	81.37
%Diff to All Bag Mean		-6.39	-25.10	1.64	1.09	-6.63	-3.83	0.54	-0.01	-23.62	434.71	-3.93
Ford												
4/17/2019	0	0.0076	0.1026	0.0027	202.4	0.0058	0.0017	8.9176	8.2534	0.000	0.000	0.000
4/18/2019	0	0.0096	0.1101	0.0012	200.7	0.0078	0.0018	8.8425	8.2588	0.000	0.000	0.000
4/24/2019	0	0.0082	0.1175	0.0028	197.5	0.0065	0.0017	8.7024	8.2458	0.000	0.000	0.000
4/26/2019	0	0.0111	0.1401	0.0044	200.4	0.0089	0.0022	8.8305	8.2562	0.000	0.000	0.000
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	Diff	No Diff	Diff	Diff
Min		0.0076	0.103	0.0012	197.5	0.0058	0.0017	8.70	8.246	0.0000	0.000	0.000
Mean		0.0091	0.118	0.0028	200.3	0.0072	0.0019	8.82	8.254	0.0000	0.000	0.000
Max		0.0111	0.140	0.0044	202.4	0.0089	0.0022	8.92	8.259	0.0000	0.000	0.000
Std Dev		0.0016	0.016	0.0013	2.04	0.0014	0.0003	0.09	0.006	0.0000	0.000	0.000
CV		17.47	13.78	47.41	1.02	18.89	13.46	1.01	0.07	---	---	---
%Diff to All Bag Mean		0.31	-33.21	-25.32	-1.29	-1.84	5.37	-1.02	0.02	-100.00	-100.00	-100.00
GM												
5/1/2019	0	0.0120	0.1750	0.0050	200.4	0.0100	0.0020	8.90	8.2450	0.870	-0.480	0.570
5/2/2019	0	0.0090	0.1240	0.0040	200.9	0.0070	0.0020	8.91	8.2470	3.030	-0.290	2.190
5/3/2019	0	0.0120	0.1790	0.0040	201.4	0.0100	0.0020	8.94	8.2440	2.380	0.100	1.940
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0090	0.124	0.0040	200.4	0.0070	0.0020	8.90	8.244	0.8700	-0.480	0.570
Mean		0.0110	0.159	0.0043	200.9	0.0090	0.0020	8.92	8.245	2.0933	-0.223	1.5667
Max		0.0120	0.179	0.0050	201.4	0.0100	0.0020	8.94	8.247	3.0300	0.100	2.1900
Std Dev		0.002	0.031	0.0006	0.50	0.002	0.000	0.02	0.002	1.1082	0.296	0.8721
CV		15.75	19.25	13.32	0.25	19.25	0.00	0.23	0.02	52.94	-132.40	55.67
%Diff to All Bag Mean		21.25	-9.49	17.69	-0.97	22.23	13.15	0.02	-0.08	14.79	-499.06	19.40
EPA												
5/15/2019	0	0.0112	0.8507	0.0050	210.6	0.0093	0.0025	9.27	8.261	2.230	-0.250	1.140
5/16/2019	0	0.0068	0.1417	0.0025	209.8	0.0050	0.0019	9.19	8.281	5.130	0.010	3.220
5/29/2019	0	0.0081	0.1131	0.0056	207.5	0.0062	0.0019	9.09	8.269	4.620	0.250	3.000
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	No Diff	No Diff	Diff	Diff	No Diff	No Diff	No Diff
Min		0.007	0.1131	0.002	207.5	0.0050	0.002	9.0851	8.261	2.2300	-0.250	1.140
Mean		0.009	0.3685	0.004	209.3	0.0068	0.002	9.18	8.270	3.9933	0.003	2.4533
Max		0.011	0.8507	0.006	210.6	0.0093	0.002	9.27	8.281	5.1300	0.250	3.2200
Std Dev		0.002	0.4178	0.002	1.59	0.0022	0.000	0.09	0.011	1.5482	0.250	1.1427
CV		25.75	113.39	37.80	0.76	32.78	17.32	1.02	0.13	38.77	750.00	46.58
%Diff to All Bag Mean		-4.11	109.32	18.13	3.18	-7.17	17.18	3.00	0.22	118.97	-94.04	86.98
FCA_CPG_conf												
6/10/2019	7	0.0080	0.1982	0.0030	200.4560	0.0064	0.0017	8.8230	8.2460	0.696	0.152	0.567
6/11/2019	7	0.0070	0.1393	0.0037	201.2610	0.0054	0.0017	8.8458	8.2500	1.419	0.253	1.082
6/12/2019	7	0.0091	0.1548	0.0043	200.3040	0.0074	0.0018	8.7929	8.2410	2.313	0.425	1.718
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0070	0.139	0.0030	200.3	0.0054	0.0017	8.79	8.2410	0.6960	0.152	0.567
Mean		0.0080	0.164	0.0037	200.7	0.0064	0.0017	8.82	8.246	1.4760	0.277	1.1223
Max		0.0091	0.198	0.0043	201.3	0.0074	0.0018	8.85	8.250	2.3130	0.425	1.7180
Std Dev		0.0010	0.031	0.0007	0.51	0.0010	0.0001	0.03	0.005	0.8100	0.138	0.5766
CV		13.00	18.62	18.34	0.26	15.31	4.07	0.30	0.05	54.88	49.89	51.37
%Diff to All Bag Mean		-11.78	-6.78	0.12	-1.08	-13.49	-2.69	-1.05	-0.07	-19.06	394.36	-14.46
ECCC												
9/13/2019	0	0.0137	0.165	0.0056	201.4	0.0118	0.0019	8.93	8.240	3.143	-0.113	1.916
9/17/2019	0	0.0081	0.145	0.0019	199.2	0.0068	0.0012	8.48	8.240	1.948	0.201	1.369
9/19/2019	0	0.0062	0.137	0.0031	202.7	0.0056	0.0006	8.98	8.256	3.122	-0.336	2.487
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0062	0.137	0.002	199.2	0.0056	0.0006	8.48	8.240	1.9482	-0.336	1.369
Mean		0.0093	0.149	0.0035	201.1	0.0081	0.0012	8.80	8.245	2.7378	-0.083	1.9242
Max		0.0137	0.165	0.006	202.7	0.0118	0.0019	8.98	8.256	3.1433	0.201	2.4874
Std Dev		0.0039	0.015	0.002	1.8	0.0033	0.0006	0.28	0.009	0.6839	0.270	0.5592
CV		41.63	9.82	53.91	0.88	40.70	50.00	3.13	0.11	24.98	-327.09	29.06
%Diff to All Bag Mean		2.74	-15.29	-4.37	-0.86	9.71	-29.69	-1.32	-0.08	50.13	-247.53	46.65

Table 8 - WLTP Phase4 Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Modal Data – Total

DATE	CELL	Total (Modal)							
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	el Consumpt L/100Km	Distance Km
Bag Data									
All Modal Mean		0.0260	0.231	0.0045	228.2	0.0233	0.0024	9.90	23.266
Std Dev		0.0107	0.104	0.0020	9.59	0.0109	0.0006	0.43	0.040
CV		41.07	44.96	44.12	4.20	46.65	26.65	4.30	0.17
FCA_CPG									
4/1/2019	7	0.0270	0.2423	0.0054	229.6	0.0244	0.0030	10.07	23.282
4/2/2019	7	0.0236	0.2541	0.0062	232.0	0.0211	0.0028	10.15	23.285
4/3/2019	7	0.0251	0.2446	0.0066	233.2	0.0226	0.0029	10.20	23.208
4/4/2019	7	0.0259	0.2756	0.0056	232.0	0.0232	0.0030	10.15	23.215
T-test to All Bag Mean		No Diff	No Diff	Diff	Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0236	0.242	0.005	229.6	0.0211	0.0028	10.07	23.208
Mean		0.0254	0.254	0.0060	231.7	0.0228	0.0029	10.14	23.248
Max		0.0270	0.276	0.0066	233.2	0.0244	0.0030	10.20	23.285
Std Dev		0.0014	0.015	0.0006	1.51	0.0014	0.0001	0.06	0.042
CV		5.63	5.97	9.26	0.65	6.01	3.27	0.55	0.18
% Diff to All Modal Mean		-2.28	9.79	30.90	1.55	-2.14	20.46	2.44	-0.08
% Diff to All Bag Mean		21.23	21.25	35.65	1.97	23.12	15.95	1.53	-0.10
GM									
5/1/2019	0	0.0250	0.167	0.0060	239.1	---	---	---	23.296
5/2/2019	0	0.0290	0.187	0.0060	233.4	---	---	---	23.277
5/3/2019	0	0.0300	0.208	0.0060	233.1	---	---	---	23.253
T-test to All Bag Mean		No Diff	No Diff	Diff	Diff	—	—	—	No Diff
Min		0.0250	0.167	0.0060	233.1	0.0000	0.0000	0.0	23.253
Mean		0.0280	0.1873	0.0060	235.2	---	---	---	23.275
Max		0.0300	0.208	0.0060	239.1	0.0000	0.0000	0.0	23.296
Std Dev		0.0026	0.0205	0.0000	3.36	---	---	---	0.022
CV		9.45	10.94	0.00	1.43	---	---	---	0.09
% Diff to All Modal Mean		7.73	-19.08	32.00	3.09	---	---	---	0.04
% Diff to All Bag Mean		33.64	-10.63	36.79	3.52	---	---	---	0.02
EPA									
5/15/2019	0	0.0603	0.600	0.0037	229.0	0.0547	0.0037	10.06	23.309
5/16/2019	0	0.0280	0.217	0.0019	207.2	0.0267	0.0025	9.08	23.346
5/29/2019	0	0.0193	0.139	0.0031	202.1	0.0180	0.0025	8.85	23.319
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	No Diff	No Diff	Diff	Diff
Min		0.0193	0.139	0.0019	202.1	0.0180	0.002	8.85	23.309
Mean		0.0358	0.319	0.0029	212.8	0.0331	0.0029	9.33	23.325
Max		0.0603	0.600	0.0037	229.0	0.0547	0.004	10.06	23.346
Std Dev		0.0216	0.247	0.0009	14.28	0.0192	0.001	0.64	0.019
CV		60.30	77.38	32.73	6.71	57.80	24.74	6.90	0.08
% Diff to All Modal Mean		37.87	37.61	-36.20	-6.75	42.09	19.42	-5.73	0.25
% Diff to All Bag Mean		71.03	51.98	-33.89	-6.36	78.77	14.95	-6.56	0.24
FCA_CPG_cor									
6/10/2019	7	0.0115	0.188	0.0046	229.3	0.0100	0.0019	10.08	23.230
6/11/2019	7	0.0149	0.185	0.0060	230.7	0.0132	0.0020	10.13	23.231
6/12/2019	7	0.0275	0.180	0.0046	228.7	0.0258	0.0019	10.05	23.224
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0115	0.180	0.0046	228.7	0.0100	0.0019	10.05	23.224
Mean		0.0180	0.184	0.0051	229.6	0.0163	0.0019	10.09	23.228
Max		0.0275	0.188	0.0060	230.7	0.0258	0.0020	10.13	23.231
Std Dev		0.0084	0.004	0.0008	1.03	0.0084	0.0001	0.04	0.004
CV		46.92	2.05	15.95	0.45	51.14	2.99	0.41	0.02
% Diff to All Modal Mean		-30.87	-20.47	11.47	0.61	-29.97	-20.38	1.90	-0.16
% Diff to All Bag Mean		-14.25	-12.17	15.52	1.03	-11.90	-23.36	0.99	-0.18
ECCC									
9/13/2019	0	0.0249	0.204	0.0058	230.4	0.0227	0.0022	9.95	23.239
9/17/2019	0	0.0156	0.203	0.0003	228.5	0.0138	0.0018	9.87	23.287
9/19/2019	0	0.0284	0.211	0.0008	232.3	0.0270	0.0014	10.04	23.255
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0156	0.203	0.0003	228.5	0.0138	0.0014	9.87	23.239
Mean		0.0230	0.206	0.0023	230.4	0.0212	0.0018	9.96	23.260
Max		0.0284	0.211	0.0058	232.3	0.0270	0.0022	10.04	23.287
Std Dev		0.0066	0.005	0.0030	1.90	0.0067	0.0004	0.08	0.025
CV		28.87	2.21	130.09	0.82	31.83	23.28	0.85	0.11
% Diff to CTC init.		-9.63	-19.03	-60.63	-0.55	-7.27	-38.83	-1.81	0.06
%Diff to All Bag Mean		9.56	-1.83	-46.60	1.40	14.17	-29.07	-0.31	-0.04

Table 9 - WLTP Modal Total Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 1 Modal Data

DATE	CELL	Phase1 (Modal)							
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	l Consump L/100Km	Distance Km
Bag Data									
All Modal Mean		0.1633	0.933	0.0	380.4	0.1502	0.0128	16.44	3.102
Std Dev		0.076	0.311	0.0074	31.0	0.0828	0.0040	1.38	0.014
CV		46.60	33.27	51.10	8.15	55.11	31.13	8.38	0.45
FCA_CPG									
4/1/2019	7	0.1588	1.181	0.017	391.7	0.145	0.016	17.206	3.100
4/2/2019	7	0.1392	1.260	0.027	390.2	0.125	0.016	17.154	3.105
4/3/2019	7	0.1635	1.285	0.025	403.9	0.149	0.017	17.756	3.082
4/4/2019	7	0.1506	1.369	0.021	388.2	0.135	0.017	17.082	3.084
T-test to All Bag Mean		No Diff	Diff	Diff	Diff	No Diff	Diff	No Diff	No Diff
Min		0.1392	1.181	0.0168	388.2	0.1249	0.0156	17.08	3.082
Mean		0.1530	1.274	0.0224	393.5	0.1386	0.0165	17.30	3.093
Max		0.1635	1.369	0.0269	403.9	0.1490	0.0174	17.76	3.105
Std Dev		0.0106	0.078	0.0045	7.08	0.0108	0.0007	0.31	0.011
CV		6.96	6.10	20.07	1.80	7.83	4.53	1.79	0.37
% Diff to All Modal Mean		-6.28	36.47	55.63	3.45	-7.72	28.82	5.23	-0.30
% Diff to All Bag Mean		17.83	50.18	97.29	3.03	23.72	31.05	4.83	-0.35
GM									
5/1/2019	0	0.1510	0.7200	0.0130	417.9	---	---	---	3.1120
5/2/2019	0	0.1910	0.9850	0.0110	396.7	---	---	---	3.1050
5/3/2019	0	0.1900	1.0280	0.0140	396.2	---	---	---	3.0930
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	--	--	--	No Diff
Min		0.1510	0.720	0.0110	396.2	0.0000	0.0000	0.00	3.093
Mean		0.1773	0.911	0.0127	403.6	--	--	--	3.103
Max		0.1910	1.028	0.0140	417.9	0.0000	0.0000	0.00	3.112
Std Dev		0.0228	0.167	0.0015	12.38	---	---	---	0.010
CV		12.86	18.31	12.06	3.07	---	---	---	0.31
% Diff to All Modal Mean		8.61	-2.41	-11.99	6.11	---	---	---	0.04
% Diff to All Bag Mean		36.55	7.40	11.56	5.67	---	---	---	-0.01
EPA									
5/15/2019	0	0.4132	1.412	0.0230	363.2	0.3983	0.0199	16.04	3.108
5/16/2019	0	0.1852	0.958	0.0093	313.6	0.1833	0.0143	13.80	3.120
5/29/2019	0	0.1174	0.539	0.0118	299.3	0.1156	0.0106	13.14	3.125
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	No Diff	No Diff	Diff	No Diff
Min		0.117	0.5388	0.009	299.3	0.1156	0.011	13.1441	3.108
Mean		0.239	0.9694	0.015	325.4	0.2324	0.015	14.33	3.118
Max		0.413	1.4118	0.023	363.2	0.3983	0.020	16.04	3.125
Std Dev		0.155	0.4367	0.007	33.5	0.1476	0.0047	1.52	0.009
CV		64.94	45.04	49.52	10.31	63.52	31.46	10.58	0.29
% Diff to All Modal Mean		46.15	3.85	2.18	-14.46	54.77	16.61	-12.85	0.50
% Diff to All Bag Mean		83.73	14.28	29.53	-14.81	107.49	18.63	-13.18	0.46
FCA_CPG_cor									
6/10/2019	7	0.0771	0.483	0.0148	390.0	0.0689	0.0097	17.17	3.085
6/11/2019	7	0.0835	0.5849	0.0135	387.3	0.0749	0.0098	17.0405	3.0880
6/12/2019	7	0.1371	0.4991	0.0134	384.2	0.1292	0.0090	16.9054	3.0920
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.0771	0.483	0.0134	384.2	0.0689	0.0090	16.91	3.0850
Mean		0.0992	0.522	0.0139	387.2	0.0910	0.0095	17.04	3.088
Max		0.1371	0.585	0.0148	390.0	0.1292	0.0098	17.17	3.092
Std Dev		0.0329	0.055	0.0008	2.90	0.0332	0.0004	0.13	0.004
CV		33.20	10.46	5.62	0.75	36.50	4.59	0.77	0.11
% Diff to All Modal Mean		-39.22	-44.03	-3.42	1.79	-39.40	-25.72	3.64	-0.44
% Diff to All Bag Mean		-23.59	-38.41	22.42	1.37	-18.75	-24.43	3.25	-0.49
ECCC									
9/13/2019	0	0.1410	0.884	0.0150	388.0	0.1309	0.0101	16.82	3.106
9/17/2019	0	0.1104	0.867	0.0032	385.4	0.1018	0.0086	16.70	3.106
9/19/2019	0	0.2033	0.880	-0.0013	390.1	0.1949	0.0084	16.91	3.122
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff	No Diff
Min		0.1104	0.867	-0.0013	385.4	0.1018	0.0084	16.70	3.106
Mean		0.1516	0.877	0.0056	387.8	0.1425	0.0090	16.81	3.111
Max		0.2033	0.884	0.0150	390.1	0.1949	0.0101	16.91	3.122
Std Dev		0.0474	0.009	0.0084	2.3	0.0476	0.0009	0.11	0.01
CV		31.25	0.99	149.71	0.60	33.42	9.92	0.63	0.30
% Diff to CTC init.		---	---	---	---	---	---	---	---
%Diff to All Bag Mean		16.71	3.40	-50.49	1.54	27.26	-28.09	1.85	0.25

Table 10 - WLTP Phase1Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 2 Modal Data

DATE	CELL	Phase2 (Modal)							
		HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	Consump L/100Km	Distance Km
Bag Data									
All Modal Mean		0.0023	0.068	0.004	231.5	0.0022	0.0003	10.05	4.754
Std Dev		0.0045	0.026	0.002	11.3	0.0049	0.0004	0.54	0.012
CV		192.93	38.14	42.12	4.87	219.49	107.88	5.34	0.25
FCA_CPG									
4/1/2019	7	0.0050	0.065	0.0059	232.1	0.0044	0.0007	10.16	4.759
4/2/2019	7	0.0039	0.081	0.0038	236.2	0.0036	0.0004	10.32	4.759
4/3/2019	7	0.0016	0.062	0.0050	236.8	0.0013	0.0004	10.35	4.743
4/4/2019	7	0.0045	0.053	0.0047	237.0	0.0042	0.0004	10.35	4.745
T-test to All Bag Mean		Diff	No Diff	No Diff	Diff	Diff	No Diff	No Diff	No Diff
Min		0.0016	0.053	0.0038	232.1	0.0013	0.0004	10.16	4.743
Mean		0.0038	0.065	0.0049	235.5	0.0034	0.0005	10.29	4.752
Max		0.0050	0.081	0.0059	237.0	0.0044	0.0007	10.35	4.759
Std Dev		0.0015	0.012	0.0009	2.31	0.0014	0.0002	0.09	0.009
CV		40.06	17.68	17.86	0.98	42.21	31.58	0.89	0.18
% Diff to All Modal Mean		61.39	-4.18	8.48	1.75	51.81	43.20	2.40	-0.05
% Diff to All Bag Mean		296.56	0.93	28.52	2.09	766.99	-10.33	2.49	-0.08
GM									
5/1/2019	0	0.0010	0.0330	0.0070	241.0	---	---	---	4.7630
5/2/2019	0	0.0010	0.0690	0.0060	233.3	---	---	---	4.7610
5/3/2019	0	0.0010	0.0250	0.0080	234.8	---	---	---	4.7570
T-test to All Bag Mean		No Diff	No Diff	Diff	Diff	--	--	--	No Diff
Min		0.0010	0.025	0.0060	233.3	0.0000	0.0000	0.00	4.757
Mean		0.0010	0.042	0.0070	236.3	--	--	--	4.760
Max		0.0010	0.069	0.0080	241.0	0.0000	0.0000	0.00	4.763
Std Dev		0.0000	0.023	0.0010	4.07	---	---	---	0.003
CV		0.00	55.37	14.29	1.72	---	---	---	0.06
% Diff to All Modal Mean		-56.96	-37.64	56.57	2.10	---	---	---	0.13
% Diff to All Bag Mean		5.75	-34.32	85.50	2.44	---	---	---	0.11
EPA									
5/15/2019	0	0.0012	0.094	0.0037	229.5	0.0000	0.0006	10.04	4.762
5/16/2019	0	0.0012	0.071	0.0025	204.8	0.0000	0.0006	8.96	4.764
5/29/2019	0	0.0012	0.043	0.0037	202.9	0.0000	0.0006	8.88	4.760
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	Diff	No Diff	Diff	No Diff
Min		0.001	0.0429	0.002	202.9	0.0000	0.001	8.88	4.760
Mean		0.001	0.0696	0.003	212.4	0.0000	0.001	9.30	4.762
Max		0.001	0.0945	0.004	229.5	0.0000	0.001	10.04	4.764
Std Dev		0.000	0.0258	0.001	14.81	0.0000	0.000	0.65	0.002
CV		0.00	37.13	21.65	6.97	---	0.00	6.99	0.03
% Diff to All Modal Mean		-46.51	2.52	-25.87	-8.24	-100.00	87.34	-7.54	0.17
% Diff to All Bag Mean		31.43	7.98	-12.18	-7.93	-100.00	17.31	-7.45	0.14
FCA_CPG_cor									
6/10/2019	7	0.0000	0.098	0.0049	236.6	0.0000	0.0004	10.40	4.749
6/11/2019	7	0.0022	0.116	0.0039	242.7	0.0018	0.0005	10.67	4.741
6/12/2019	7	0.0171	0.091	0.0047	236.9	0.0167	0.0004	10.40	4.743
T-test to All Bag Mean		No Diff	Diff	No Diff	Diff	No Diff	Diff	Diff	Diff
Min		0.0000	0.091	0.0039	236.6	0.0000	0.0004	10.40	4.7410
Mean		0.0064	0.102	0.0045	238.7	0.0062	0.0004	10.49	4.744
Max		0.0171	0.116	0.0049	242.7	0.0167	0.0005	10.67	4.749
Std Dev		0.0093	0.013	0.0005	3.44	0.0092	0.0001	0.16	0.004
CV		144.60	12.41	11.76	1.44	148.64	13.32	1.50	0.09
% Diff to All Modal Mean		176.87	49.56	0.65	3.13	177.38	30.64	4.33	-0.20
% Diff to All Bag Mean		580.33	57.54	19.25	3.48	1484.14	-18.19	4.43	-0.23
ECCC									
9/13/2019	0	0.0017	0.032	0.0047	233.9	0.0017	0.0000	10.09	4.748
9/17/2019	0	-0.0037	0.082	-0.0002	231.0	-0.0033	-0.0004	9.97	4.780
9/19/2019	0	-0.0019	0.072	0.0032	234.2	-0.0015	-0.0004	10.11	4.731
T-test to All Bag Mean		No Diff	Diff	No Diff	No Diff				
Min		-0.0037	0.032	-0.0002	231.0	-0.0033	-0.0004	9.97	4.731
Mean		-0.0013	0.062	0.0026	233.0	-0.0010	-0.0003	10.05	4.753
Max		0.0017	0.082	0.0047	234.2	0.0017	0.0000	10.11	4.780
Std Dev		0.0027	0.026	0.0025	1.8	0.0026	0.0002	0.07	0.025
CV		-213.44	42.80	98.18	0.76	-246.93	-79.77	0.74	0.52
% Diff to CTC init.		---	---	---	---	---	---	---	---
%Diff to All Bag Mean		-235.72	-4.01	-32.06	1.01	-365.30	-147.33	0.11	-0.05

Table 11 - WLTP Phase2 Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 3 Modal Data

DATE	CELL	Phase3 (Modal)							
		HC GPM	CO GPM	NOx GPM	CO2 GPM	NMHC GPM	CH4 GPM	Consum MPG	Distance Km
Bag Data									
All Modal Mean		0.0015	0.072	0.0026	187.7	0.0014	0.0002	8.15	7.158
Std Dev		0.0020	0.028	0.0016	7.6	0.0023	0.0002	0.35	0.012
CV		133.84	39.21	63.05	4.06	162.54	92.32	4.35	0.17
FCA_CPG									
4/1/2019	7	0.0036	0.086	0.0029	189.8	0.0036	0.0006	8.31	7.17
4/2/2019	7	0.0032	0.083	0.0026	192.4	0.0032	0.0004	8.42	7.16
4/3/2019	7	0.0013	0.059	0.0029	191.7	0.0013	0.0003	8.39	7.14
4/4/2019	7	0.0035	0.103	0.0025	192.3	0.0035	0.0003	8.42	7.14
T-test to All Bag Mean		Diff	No Diff	No Diff	Diff	Diff	No Diff	Diff	No Diff
Min		0.0013	0.059	0.0025	189.8	0.0013	0.0003	8.31	7.139
Mean		0.0029	0.083	0.0027	191.6	0.0029	0.0004	8.39	7.153
Max		0.0036	0.103	0.0029	192.4	0.0036	0.0006	8.42	7.165
Std Dev		0.0011	0.018	0.0002	1.21	0.0011	0.0001	0.05	0.014
CV		37.25	21.71	7.57	0.63	37.25	35.36	0.61	0.19
% Diff to All Modal Mean		95.44	14.38	5.43	2.03	103.33	77.11	2.94	-0.07
% Diff to All Bag Mean		207.19	22.19	0.30	3.03	390.43	-2.96	2.73	-0.09
GM									
5/1/2019	0	0.0010	0.0500	0.0030	196.8	---	---	---	7.1660
5/2/2019	0	0.0010	0.0200	0.0040	191.9	---	---	---	7.1640
5/3/2019	0	0.0010	0.0360	0.0030	189.9	---	---	---	7.1590
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	--	--	--	No Diff
Min		0.0010	0.020	0.0030	189.9	0.0000	0.0000	0.00	7.159
Mean		0.0010	0.035	0.0033	192.9	--	--	--	7.163
Max		0.0010	0.050	0.0040	196.8	0.0000	0.0000	0.00	7.166
Std Dev		0.000	0.015	0.0006	3.54	---	---	---	0.004
CV		0.00	42.48	17.32	1.84	---	---	---	0.05
% Diff to All Modal Mean		-32.61	-51.25	28.96	2.72	---	---	---	0.07
% Diff to All Bag Mean		5.93	-47.92	22.69	3.73	---	---	---	0.05
EPA									
5/15/2019	0	0.0006	0.070	0.0025	186.0	0.0000	0.0000	8.14	7.179
5/16/2019	0	0.0006	0.089	0.0025	173.0	0.0000	0.0000	7.57	7.181
5/29/2019	0	0.0006	0.057	0.0019	166.7	0.0000	0.0000	7.30	7.165
T-test to All Bag Mean		No Diff	No Diff	No Diff	Diff	No Diff	Diff	Diff	No Diff
Min		0.001	0.0572	0.002	166.7	0.0000	0.000	7.2958	7.165
Mean		0.001	0.0721	0.002	175.3	0.0000	0.000	7.67	7.175
Max		0.001	0.0889	0.002	186.0	0.0000	0.000	8.14	7.181
Std Dev		0.000	0.0159	0.000	9.86	0.0000	0.000	0.43	0.009
CV		0.00	22.10	15.75	5.63	---	---	5.62	0.12
% Diff to All Modal Mean		-58.12	-0.55	-11.85	-6.65	-100.00	-100.00	-5.88	0.24
% Diff to All Bag Mean		-34.18	6.25	-16.14	-5.74	-100.00	-100.00	-6.07	0.22
FCA_CPG_cor									
6/10/2019	7	0.0000	0.094	0.0024	190.5	0.0000	0.0003	8.38	7.151
6/11/2019	7	0.0020	0.108	0.0068	190.9	0.0020	0.0004	8.38	7.152
6/12/2019	7	0.0062	0.127	0.0018	191.3	0.0062	0.0003	8.41	7.147
T-test to All Bag Mean		No Diff	Diff	No Diff					
Min		0.0000	0.094	0.0018	190.5	0.0000	0.0003	8.38	7.1470
Mean		0.0027	0.110	0.0037	190.9	0.0027	0.0003	8.39	7.150
Max		0.0062	0.127	0.0068	191.3	0.0062	0.0004	8.41	7.152
Std Dev		0.0032	0.017	0.0027	0.40	0.0032	0.0001	0.02	0.003
CV		115.77	15.21	74.46	0.21	115.77	17.32	0.20	0.04
% Diff to All Modal Mean		84.20	51.36	41.86	1.68	91.64	47.59	2.94	-0.11
% Diff to All Bag Mean		189.54	61.69	34.96	2.68	362.24	-19.14	2.73	-0.13
ECCC									
9/13/2019	0	0.0023	0.055	0.0034	185.6	0.0021	0.0001	8.01	7.145
9/17/2019	0	-0.0020	0.048	-0.0005	185.6	-0.0024	0.0003	8.01	7.162
9/19/2019	0	-0.0011	0.074	-0.0003	189.4	-0.0010	-0.0001	8.19	7.145
T-test to All Bag Mean		No Diff							
Min		-0.0020	0.048	-0.001	185.6	-0.0024	-0.0001	8.01	7.145
Mean		-0.0003	0.059	0.0009	186.9	-0.0004	0.0001	8.07	7.151
Max		0.0023	0.074	0.003	189.4	0.0021	0.0003	8.19	7.162
Std Dev		0.0023	0.013	0.002	2.2	0.0023	0.0002	0.10	0.009
CV		-740.50	22.21	250.05	1.19	-554.75	206.64	1.28	0.13
% Diff to CTC init.		---	---	---	---	---	---	---	---
%Diff to All Bag Mean		-132.57	-13.18	-67.86	0.52	-170.94	-72.82	-1.18	-0.12

Table 12 - WLTP Phase3 Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP Phase 4 Modal Data

DATE	CELL	Phase4 (Modal)							
		HC GPM	CO GPM	NOx GPM	CO2 GPM	NMHC GPM	CH4 GPM	l Consump MPG	Distance Km
Bag Data									
All Modal Mean		0.0091	0.200	0.0037	204.1	0.0068	0.0017	8.88	8.251
Std Dev		0.0029	0.227	0.0016	5.3	0.0026	0.0005	0.23	0.012
CV		31.33	113.60	43.22	2.57	37.89	31.82	2.59	0.14
FCA_CPG									
4/1/2019	7	0.0101	0.1279	0.0031	201.9	0.0087	0.0016	8.8	8.26
4/2/2019	7	0.0090	0.1242	0.0028	204.3	0.0078	0.0013	8.9	8.26
4/3/2019	7	0.0073	0.1211	0.0039	203.2	0.0060	0.0015	8.9	8.24
4/4/2019	7	0.0106	0.1442	0.0032	205.1	0.0092	0.0015	9.0	8.24
T-test to All Bag Mean		No Diff	No Diff						
Min		0.0073	0.121	0.0028	201.9	0.0060	0.0013	8.83	8.244
Mean		0.0093	0.129	0.0033	203.6	0.0079	0.0015	8.91	8.251
Max		0.0106	0.144	0.0039	205.1	0.0092	0.0016	8.97	8.258
Std Dev		0.0015	0.010	0.0005	1.39	0.0014	0.0001	0.06	0.008
CV		15.80	7.95	14.32	0.68	17.77	8.53	0.68	0.09
% Diff to All Modal Mean		1.37	-35.33	-11.54	-0.24	15.81	-12.79	0.34	-0.01
% Diff to All Bag Mean		1.96	-26.52	-11.74	0.37	7.63	-16.55	-0.07	-0.01
GM									
5/1/2019	0	0.0120	0.1390	0.0050	207.3	---	---	---	8.2450
5/2/2019	0	0.0090	0.0980	0.0050	208.1	---	---	---	8.2470
5/3/2019	0	0.0110	0.1550	0.0040	208.6	---	---	---	8.2440
T-test to All Bag Mean		No Diff	No Diff	No Diff	No Diff	--	--	--	No Diff
Min		0.0090	0.098	0.0040	207.3	0.0000	0.0000	0.00	8.244
Mean		0.0107	0.131	0.0047	208.0	--	--	--	8.245
Max		0.0120	0.155	0.0050	208.6	0.0000	0.0000	0.00	8.247
Std Dev		0.002	0.029	0.0006	0.64	---	---	---	0.002
CV		14.32	22.50	12.37	0.31	---	---	---	0.02
% Diff to All Modal Mean		16.90	-34.67	27.02	1.90	---	---	---	-0.07
% Diff to All Bag Mean		17.58	-25.78	26.74	2.52	---	---	---	-0.08
EPA									
5/15/2019	0	0.0130	1.046	0.0050	215.4	0.0043	0.0031	9.50	8.261
5/16/2019	0	0.0075	0.133	0.0031	198.3	0.0062	0.0019	8.68	8.281
5/29/2019	0	0.0093	0.115	0.0068	195.4	0.0081	0.0019	8.55	8.269
T-test to All Bag Mean		No Diff	Diff						
Min		0.007	0.1150	0.003	195.4	0.0043	0.002	8.5538	8.261
Mean		0.010	0.4315	0.005	203.0	0.0062	0.002	8.91	8.270
Max		0.013	1.0464	0.007	215.4	0.0081	0.003	9.50	8.281
Std Dev		0.003	0.5327	0.002	10.84	0.0019	0.001	0.51	0.011
CV		28.64	123.46	37.50	5.34	30.00	31.49	5.73	0.13
% Diff to All Modal Mean		8.96	115.71	35.31	-0.53	-9.19	34.72	0.37	0.23
% Diff to All Bag Mean		9.59	145.09	35.01	0.08	-15.60	28.90	-0.04	0.22
FCA_CPG_cor									
6/10/2019	7	0.0034	0.210	0.0026	198.5	0.0025	0.0013	8.71	8.246
6/11/2019	7	0.0075	0.140	0.0038	199.8	0.0062	0.0014	8.76	8.250
6/12/2019	7	0.0107	0.158	0.0037	198.1	0.0094	0.0015	8.71	8.241
T-test to All Bag Mean		No Diff	No Diff						
Min		0.0034	0.140	0.0026	198.1	0.0025	0.0013	8.71	8.2410
Mean		0.0072	0.169	0.0034	198.8	0.0060	0.0014	8.73	8.246
Max		0.0107	0.210	0.0038	199.8	0.0094	0.0015	8.76	8.250
Std Dev		0.0037	0.036	0.0007	0.89	0.0035	0.0001	0.03	0.005
CV		50.82	21.44	19.78	0.45	57.23	7.14	0.34	0.05
% Diff to All Modal Mean		-21.10	-15.32	-8.36	-2.60	-11.83	-17.22	-1.67	-0.07
% Diff to All Bag Mean		-20.64	-3.79	-8.57	-2.01	-18.06	-20.80	-2.07	-0.07
ECCC									
9/13/2019	0	0.0141	0.175	0.0052	207.8	0.0117	0.0024	8.98	8.240
9/17/2019	0	0.0063	0.156	0.0003	205.3	0.0046	0.0017	8.87	8.240
9/19/2019	0	0.0052	0.157	0.0012	208.7	0.0042	0.0010	9.02	8.256
T-test to All Bag Mean		No Diff	No Diff						
Min		0.0052	0.156	0.000	205.3	0.0042	0.0010	8.87	8.240
Mean		0.0085	0.163	0.0023	207.3	0.0068	0.0017	8.95	8.245
Max		0.0141	0.175	0.005	208.7	0.0117	0.0024	9.02	8.256
Std Dev		0.0049	0.011	0.003	1.8	0.0042	0.0007	0.08	0.009
CV		56.96	6.49	115.69	0.86	62.10	39.90	0.86	0.11
% Diff to CTC init.		---	---	---	---	---	---	---	---
%Diff to All Bag Mean		-6.04	-7.53	-38.72	2.16	-7.10	-4.74	0.43	-0.08

Table 13 - WLTP Phase4 Modal Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC

WLTP PEMS Data

DATE	Total (PEMS)								
	HC GPKm	CO GPKm	NOx GPKm	CO2 GPKm	NMHC GPKm	CH4 GPKm	Consump L/100Km	Distance Km	Exh Flow cfm
Bag Data									
All PEMS Mean	0.0210	0.218	0.0057	241.2	0.0146	0.0031	10.41	18.643	863.50
Std Dev	0.0134	0.079	0.0029	8.40	0.0072	0.0013	0.36	9.649	47.7963
CV	64.00	36.06	50.22	3.48	49.00	43.09	3.48	51.76	5.54
FCA_CPG									
4/1/2019	0.0206	0.2472	0.0056	248.9	0.0180	0.0026	10.80	0.000	927.6
4/2/2019	0.0185	0.2718	0.0067	248.2	0.0165	0.0020	10.80	0.000	890.7
4/4/2019	0.0209	0.2743	0.0052	252.3	0.0183	0.0026	11.00	0.000	896.7
T-test to All Bag Mean	No Diff	No Diff	No Diff	Diff	No Diff	No Diff	Diff	Diff	—
Min	0.0185	0.247	0.005	248.2	0.0165	0.0020	10.80	0.000	890.70
Mean	0.0200	0.264	0.0058	249.8	0.0176	0.0024	10.87	0.000	905.0
Max	0.0209	0.274	0.0067	252.3	0.0183	0.0026	11.00	0.000	927.60
Std Dev	0.0013	0.015	0.0008	2.15	0.0010	0.0000	0.12	0.000	19.80
CV	6.58	5.67	13.27	0.86	5.42	15.16	1.06	---	2.19
%Diff to All PEMS Mean	-4.65	21.03	2.15	3.59	20.36	-22.06	4.36	-100.00	4.81
%Diff to All Bag Mean	-4.45	26.15	32.96	9.94	-4.92	-5.12	8.80	-100.00	---
Ford									
4/17/2019	---	0.1379	0.0042	238.7	---	---	10.00	---	---
4/18/2019	---	0.1757	0.0050	246.9	---	---	10.40	---	---
4/24/2019	---	0.1768	-0.0032	239.2	---	---	10.10	---	---
4/26/2019	---	0.1403	0.0039	238.9	---	---	10.10	---	---
T-test to All Bag Mean	—	No Diff	No Diff	Diff	—	—	No Diff	—	—
Min	0.0000	0.138	-0.0032	238.7	0.0000	0.0000	10.00	0.000	0.0000
Mean	—	0.158	0.0025	240.9	—	—	10.15	—	—
Max	0.0000	0.177	0.0050	246.9	0.0000	0.0000	10.40	0.000	0.0000
Std Dev	---	0.021	0.0038	3.99	---	---	0.17	---	---
CV	---	13.62	153.91	1.66	---	---	1.71	---	---
%Diff to All PEMS Mean	---	-27.83	-56.46	-0.10	---	---	-2.52	---	---
%Diff to All Bag Mean	---	-24.78	-43.33	6.03	---	---	1.63	---	---
GM									
5/1/2019	0.0140	0.194	0.0080	234.8	---	---	10.19	23.447	837.9
5/2/2019	0.0130	0.190	0.0070	227.7	---	---	9.91	23.446	809.4
5/3/2019	0.0150	0.220	0.0070	233.0	---	---	10.17	23.148	819.7
T-test to All Bag Mean	No Diff	No Diff	Diff	No Diff	—	—	No Diff	No Diff	—
Min	0.0130	0.190	0.0070	227.7	0.0000	0.0000	9.9	23.148	809.41
Mean	0.0140	0.2013	0.0073	231.8	—	—	10.09	23.347	822.4
Max	0.0150	0.220	0.0080	234.8	0.0000	0.0000	10.2	23.447	837.93
Std Dev	0.0010	0.0163	0.0006	3.67	---	---	0.16	0.172	14.44
CV	7.14	8.09	7.87	1.58	---	---	1.55	0.74	1.76
%Diff to All PEMS Mean	-33.32	-7.85	28.45	-3.88	---	---	-3.12	25.23	-4.76
%Diff to All Bag Mean	-33.18	-3.95	67.19	2.02	---	---	1.00	0.33	---
EPA									
5/15/2019	0.0650	0.497	0.0069	233.5	---	---	10.26	23.376	832.2
5/16/2019	0.0288	0.229	0.0031	230.3	---	---	10.09	23.402	819.2
5/22/2019	0.0197	0.124	0.0066	226.8	---	---	9.93	23.380	814.5
T-test to All Bag Mean	No Diff	No Diff	No Diff	No Diff	—	—	No Diff	Diff	—
Min	0.0197	0.124	0.0031	226.8	0.0000	0.000	9.93	23.376	814.50
Mean	0.0378	0.284	0.0055	230.2	—	—	10.09	23.386	822.0
Max	0.0650	0.497	0.0069	233.5	0.0000	0.0000	10.26	23.402	832.21
Std Dev	0.0239	0.193	0.0021	3.36	---	---	0.16	0.014	9.18
CV	63.31	67.89	37.85	1.46	---	---	1.62	0.06	1.12
%Diff to All PEMS Mean	80.13	29.79	-2.93	-4.54	---	---	-3.07	25.44	-4.81
%Diff to All Bag Mean	80.51	35.28	26.35	1.31	---	---	1.06	0.50	---
FCA_CPG_conf									
6/10/2019	0.0106	0.215	0.0049	242.8	0.0058	0.0048	10.50	23.230	842.6
6/11/2019	0.0103	0.208	0.0050	248.0	0.0055	0.0048	10.73	23.231	842.9
6/12/2019	0.0111	0.208	0.0051	241.6	0.0063	0.0048	10.45	23.224	842.1
T-test to All Bag Mean	No Diff	No Diff	No Diff	Diff	Diff	Diff	Diff	No Diff	—
Min	0.0103	0.208	0.0049	241.6	0.0055	0.0048	10.45	23.224	842.10
Mean	0.0107	0.210	0.0050	244.1	0.0059	0.0048	10.56	23.228	842.5
Max	0.0111	0.215	0.0051	248.0	0.0063	0.0048	10.73	23.231	842.90
Std Dev	0.0004	0.004	0.0001	3.43	0.0004	0.0000	0.15	0.004	0.40
CV	3.71	1.96	2.17	1.41	6.89	0.00	1.41	0.02	0.05
%Diff to All PEMS Mean	-49.15	-3.74	-12.03	1.23	-59.94	56.31	1.41	24.59	-2.43
%Diff to All Bag Mean	-49.04	0.33	14.51	7.44	-68.35	90.27	5.73	-0.18	---
ECCC									
9/13/2019	0.0223	0.217	0.0097	247.3	0.0205	0.0018	10.69	23.234	909.6000
9/17/2019	0.0175	0.203	0.0107	248.7	0.0154	0.0022	10.74	23.282	902.8000
9/19/2019	0.0276	0.222	0.0069	254.3	0.0255	0.0021	10.99	23.250	964.5000
T-test to All Bag Mean	No Diff	No Diff	Diff	Diff	No Diff	No Diff	Diff	No Diff	—
Min	0.0175	0.203	0.0069	247.3	0.0154	0.0018	10.69	23.234	902.8
Mean	0.0225	0.214	0.0091	250.1	0.0204	0.0020	10.81	23.255	925.6
Max	0.0276	0.222	0.0107	254.3	0.0255	0.0022	10.99	23.282	964.5
Std Dev	0.0050	0.010	0.0019	3.69	0.0051	0.0002	0.16	0.025	33.8
CV	22.31	4.54	21.37	1.47	24.76	9.61	1.48	0.11	3.65
%Diff to All PEMS Mean	6.99	-2.13	59.65	3.72	39.58	-34.25	3.78	24.74	7.20
%Diff to All Bag Mean	7.22	2.00	107.80	10.07	10.27	-19.97	8.20	-0.06	---

Table 14 - WLTP PEMS Data: FCA_CPG, Ford, EPA, GM, FCA_CPG_Conf, ECCC